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GOOD ROADS

DEVOTED TO THE CONSTRUCTION AND
MAINTENANCE OF ROADS
AND STREETS

51
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JANUARY—JUNE, 1917

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GOOD ROADS

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Number
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Florida Road Problems

By WM. F. COCKE*

Readers of periodicals devoted to road improvement or to the interests of automobile touring are necessarily impressed with the fact that Florida has taken her place in the front rank as a good roads state. Owing, however, to the wide range of road building materials, the almost total lack of what would usually be considered first-class material, the present extremely localized administration of highway affairs, and the cosmopolitan citizenship of a large portion of the state, there are some rather complex problems which must be met and worked out in the near future.

There is a prevailing impression that the State of Florida, from a topographical standpoint, is a level plain and that at least one-half consists of flat pine lands with the remainder divided about equally between everglades and swamps. So general is this impression that even some persons who have traveled over parts of the state will be surprised to learn that there are large areas which can correctly be termed decidedly rolling country. The highest recorded elevation in the state is a little over 300 ft. above sea level and is in Gadsden County, just west of Tallahassee, the state capital. The lowest recorded elevation of any city or town is 3 ft. above sea level, and the town thus situated is Punta Gorda, on the western coast of southern Florida.

As a rule, the counties of Florida bordering on Alabama and Georgia, west of the Suwannee River, are generally high and rolling and the surface is underlaid with lime rock. Extending from the counties of Suwannee and Columbia through the center of the peninsula, as far southward as De Soto County, there is found an elevated, rolling section underlaid with limestone and dotted with numerous lakes. The counties bordering the Atlantic Ocean and the Gulf of Mexico are flat, as a rule, and the lands adjacent to watercourses are swampy but largely susceptible of drainage.

In the extreme southern end of the peninsula is situated that vast area of Florida known as the Everglades, covering approximately 6,500 sq. miles. The state has undertaken the reclamation of the Everglades on a very large scale and great areas will soon be available for cultivation. These drainage projects are making possible several highways across that heretofore impassable region, the roadbeds being built on the spoil banks thrown up along the drainage canals. One of these roads will extend across the state from Miami, on the Atlantic, to Marco, on the Gulf Coast. The St. Johns River, flowing northward parallel with the Atlantic coast line, and at no point more than 30 mi. from the sea coast, is navigable as far up as Sanford, or at least 175 mi. from the mouth of the river.

BITUMINOUS MACADAM ROAD WITH LIMESTONE AGGREGATE AT GAINESVILLE, FLORIDA.

A GRADED EARTH ROAD NEAR THE APALACHICOLA RIVER IN FLORIDA.

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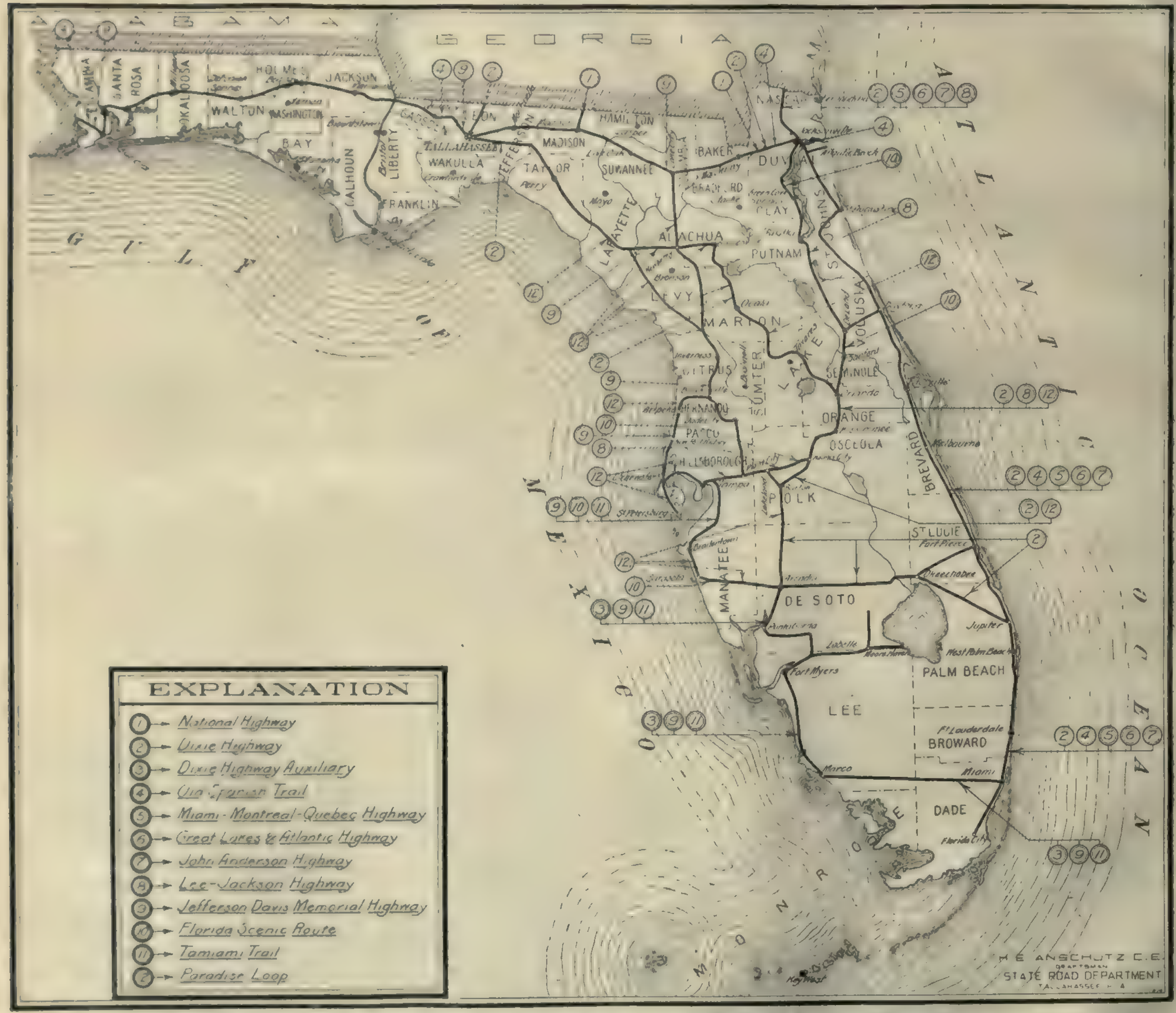
*Commissioner, Florida State Road Department.

The accompanying map shows the principal towns of the state and the several routed roads as laid out by different highway associations. It must not be inferred that all portions of the routes shown are improved, for this map is too small to show the improved and unimproved sections. Detailed information can be found on the large map of Florida gotten out by the American Automobile Association and based on data furnished by the State Road Department of Florida.



ROAD MAP OF THE STATE OF FLORIDA, SHOWING COUNTY LINES, THE PRINCIPAL CITIES AND TOWNS AND ROADS ROUTED BY VARIOUS HIGHWAY ASSOCIATIONS.

Geology as Related to Available Material for Road Construction

While a large portion of Florida is underlaid by rock, only a small percentage of this rock can be considered of value in road construction except as a base for a wearing surface of some more durable material. The hardest stone found in the state is a flint pebble overlying the phosphate deposits in the south central portion of the peninsula. This stone is very hard and tough, but unfortunately the supply is quite limited both as to area and quantity. A number of limestone outcrops occur, fairly well distributed over the state, varying from what might be classed as medium hard rock down to what is practically nothing more than a marl. All of this limestone is of comparatively recent origin and possesses little or no toughness but a high cementing value.

There are in the central portion of the state several deposits of alluvial gravel containing a rather low percentage of coarse aggregate, fitting it for use only on roads carrying light traffic. The soil in the northern part of the state consists of clay and sand, the two either forming a natural mixture suitable for road surfacing or so conveniently situated with reference to each other that sand-clay roads for light traffic can be built at a reasonable cost. The counties bordering the Atlantic Ocean and the Gulf of Mexico are fairly well supplied with shell, and shell mounds of great size are found along the banks of the St. Johns River and some other streams.

The soil of the state generally is very porous, and good subdrainage is readily obtained where the proper fall is given to outlet ditches.

Climatic Conditions

The range of temperature in Florida is comparatively small, the United States weather report of the northern portion of the state showing an average winter temperature of 52° F., and an average summer temperature of 81° F. The lowest temperature recorded is 10° F. and the highest,

A TYPICAL FLORIDA SAND-CLAY ROAD.

101° F., but such extremes are rare. The southern section of the state is practically below the line of injurious frosts. The limited range of temperature and the absence of deep freezing permits the extensive use of sand-clay and other semi-hard surfaces under more severe traffic conditions than could be considered in a cooler climate. This likewise simplifies, to some extent, the selection of asphaltic binders, although the extreme humidity is more trying on asphalt than a drier atmosphere would be.

The average rainfall is about 55 in., and what is known as the rainy season usually occurs during the months of June, July and August. During this period rains are likely to be of daily occurrence, but a moderate rainfall is generally distributed throughout the balance of the year. Except when interrupted by rain, road work can be carried on the year round.

Laws Governing Road Work

At the present time each county in Florida is a separate and distinct unit, and each such unit handles the road work within its boundaries independently of any outside control. Each county is divided into five districts, each district being represented by a county commissioner elected by popular vote. The board of county commissioners, thus formed, is the administrative body through which all road construction and maintenance are carried on, usually each commissioner being supreme in his own district. As there are 52 counties in the state, it will be seen that there are practically 260 separate road units, each working under its own system.

A CONCRETE PAVEMENT ON A ROAD THROUGH AN UNSETTLED PART OF DUVAL COUNTY—FLORIDA'S FIRST CEMENT ROAD.

Sources of Revenue

The sources of revenue for road construction and maintainence are: A county tax levy of not less than 3 nor more than 8 mills; a county license on motor-driven vehicles owned within the county, and the convict labor belonging to the county.

In addition to these, special road and bridge districts may be formed independently of the commissioners' districts. Such a special district may be bonded for road and bridge construction or an additional levy may be imposed on all property within the district. As these special districts may overlap the commissioner's districts, and in some cases overlap each other, the result causes great confusion in the county's finances.

The total bonded indebtedness of the several counties of the state for road and bridge construction is at present approximately $13,500,000, with a total assessed valuation for the state of something over $300,000,000.

CEMENT GROUTED BRICK PAVEMENT ON A SAND BASE—WINTER PARK, FLORIDA.

At present there is no state fund for road construction and maintenance.

Administration of Road Affairs

Road construction and maintenance in a majority of the counties is paid for with funds derived from the annual income sources mentioned and is carried on under the supervision of each county commissioner in his own particular district. A local man is usually employed to act as foreman, at a small advance over current wages paid for day labor. In some counties the convict labor is used while in other counties the convicts are leased to private parties or corporations and the funds thus derived are used in paying some of the free labor employed on the roads.

The law authorizing the issue of bonds for road and bridge construction by counties and districts requires that the work shall be done by contract and under the supervision of an engineer. Many of the engineers thus employed have been men of ability, but as the boards of county commissioners are alone vested with the authority to select, some have been employed who have had little previous experience other than as land surveyors.

Very little authority is given an engineer under the present system, consequently some quite competent men have been relegated to the capacity of mere instrument-men, while the county commissioner assumed the authority of giving instructions directly to the contractor.

Character of Construction

Along the northern border of the state, sand-clay has been almost universally used for road construction. The absence of deep frost as previously noted, makes this class of road suitable for more severe traffic than would be the case where deep freezing exists. The humidity is also a factor in favor of this type of construction, and where sand-clay roads have been properly constructed, with the necessary provisions for drainage, they have carried a moderate traffic at a comparatively low maintenance cost. It is not advisable, however, to attempt to maintain a sand-clay surface unless material can be found within a reasonable distance from the line of the road. If the haul on material exceeds 2 mi., it is probable that the maintenance cost on the sand-clay will exceed the maintenance plus the interest on the first cost of a more durable type of surface.

Shell has been used extensively in the counties bordering the coasts. While shell will justify a longer haul than sand-clay material, it is subject to a like limitation and will be found economical only on roads carrying a moderate traffic, or roads for local use. Some attempt has been made to surface-treat shell roads with a hot bituminous material, but with doubtful results. A well compacted shell will, however, form a base for an asphaltic wearing surface which will compare very favorably with concrete.

Broken stone roads have been constructed in many parts of the state where rock could be obtained. Some of these roads have been satisfactory, but in many cases the variable quality of the material has caused the surface to wear unevenly. The principal rock formation, as stated previously, is a limestone of extremely variable quality, ranging from rock with a hardness of approximately 12 and a toughness of 3, down to marl which can be dug with an ordinary spade. All of this material has a tendency to harden when exposed, but will usually "cup out" badly under traffic. Some of the rock quarried in the southern part of the state, while apparently soft has given very fair results when laid with an asphalt binder by the penetration method. One county has laid approximately 70 mi. of water bound macadam road, using local limestone, and has later applied a hot surface treatment of asphaltic oil covered with a coarse beach sand. These roads, when last inspected, were generally in good condition. They stand up under a rather heavy traffic much better than could be expected, considering the inferior quality of covering provided by the beach sand.

The soft limestones have a high cementing value and make an excellent base for bituminous concrete or some similar wearing surface.

In the central and southern sections of the state a considerable amount of asphaltic surface has been laid, using the local sands as a mineral aggregate. On some of this work run of bank sand was used in very much the same manner as on the sand-oil roads constructed in the vicinity of Cape Cod, Mass. On the more recent work of this kind more attention has been paid to the grading of the mineral aggregate and a mixture very nearly approaching a standard sheet asphalt has been secured.

The hardest problem in connection with laying this class of surface is to secure a suitable base at a reasonable cost. In most cases in which this type of surface has been laid, the cost of a crushed stone or a concrete base would have been prohibitive, and therefore a sand-clay base was resorted to. In the absence of deep freezing, an asphalt surface laid on a sand-clay base of proper depth should prove satisfactory if provided with a suitable binder course which would protect the asphalt from dampness and prevent creeping of the surface. The sand-clay base must, even when laid on a sandy subgrade, retain considerable dampness. Furthermore, no adequate bond can exist between a sand-clay base and a 2-in. sheet asphalt wearing surface, so it would appear to be a very doubtful practice to lay this type of surface on a sand-clay base without providing a binder course of crushed stone mixed with refined tar, which would protect the asphalt from dampness and at the same time key the surface to the base.

In nine counties brick has been laid on a sand base. The first brick roads were laid with sand filled joints and some of these have become very rough and noisy. In the more recent pavements cement grout filler has been used more extensively, and the results, so far, have been all that could be desired. In the absence of frost a well compacted sand base, confined by concrete curbs, will enable a cement grouted brick surface to carry a comparatively heavy traffic. Most of the brick roads are only 9 ft. in width, with a semi-hard surfaced shoulder of sand-clay, shell or marl on which traffic can pass without inconvenience.

Maintenance

Under the present system only a few of the counties are paying any attention to maintenance. The engineers employed on construction have been laid off as soon as, and in some cases before, actual construction was completed, and the newly finished roads turned over to inexperienced foremen or convict guards to experiment on.

State Road Department

Owing to the localized authority previously described there has been a conspicuous absence of any fixed standards in planning and constructing the roads built under many of the county bond issues. For several years there has been an incessant demand for systematic road improvement—a demand that made itself felt to such extent that the 1915 session of the Florida Legislature enacted a statute creating a state road department. This department consists of five members—one from each of the four Congressional districts and one from the state at large—appointed by the governor. The department appoints the state road commissioner, who is the executive head and chief engineer of the department. The five lay members of the department serve without compensation, other than actual traveling expenses while engaged on business connected with the department.

Owing to delay due to several causes the state road commissioner was not appointed until April, 1916, and a working force was not organized until about June 1.

While the department was given very little authority, other than to act in an advisory capacity, by the act creating it and has no funds to carry on the actual construction of roads, other than the apportionment of the federal aid fund to this state, it has behind it popular sentiment reaching throughout the state. This sentiment is strongly in favor of a system of state and state aid roads, and it is expected that the next legislature, which convenes in April, 1917, will enact the necessary legislation to provide for such a system. If such a system is provided for, both the construction and maintenance will be under the supervision of the State Road Department.

At the present time the engineering force of the department, while not engaged in assisting counties in response to requests for such assistance, is employed in mapping the principal roads of the state and in collecting data which will be of value in formulating a comprehensive plan to be presented to the next legislature.

The present organization is as follows: State Road Department: Ed. Scott, Chairman; J. D. Smith, Secretary; M. M. Smith, W. J. Hillman, and F. O. Miller. Commissioner, Wm. F. Cocke. Chief Clerk, J. P. Clarkson.

Convict Labor

At present some of the state, or felony, prisoners are employed on the State Prison Farm, some are leased to the counties at a nominal sum for work on the public roads and the others are leased to private parties or corporations for work in turpentine and lumber camps. The counties also have the use of their own jail, or misdemeanor, prisoners for road work.

The road camps, as shown under the heading "Administration," are strictly under the control of the several boards of county commissioners. As a natural consequence of this localized management, the living conditions in these camps and the efficiency of the convict labor vary materially. Some camps are operated on an efficient basis and the men provided with wholesome food and sanitary quarters, but in some camps conditions have at times been so bad that the State Prison Board was forced to interfere.

Popular sentiment is opposed to continuing the convict lease system and the next legislature is expected to combine all able-bodied prisoners, not needed on the State Prison Farm, into a state convict road force, to be worked on the roads of the state under the supervision of the State Road Department.

Federal Aid for Roads

Florida, during the next five years, will receive from the federal government for road improvement approximately $840,000. This money will be devoted to constructing the unimproved links in a main east and west highway between the Alabama state line and the Atlantic Ocean, and a main north and south highway extending from the Georgia state line southward through the center of the peninsula.

General Summary

The object of the foregoing is to give a concise and impartial statement of the road problems as they exist in Florida today. The conditions, as they have existed, have not been ideal for the upbuilding of a connected system of roads, and yet Florida can today boast that approximately 20 per cent. of her total road mileage is improved. The population of the state in 1915 was a little under 1,000,000, yet, with this small population, there have been authorized by the several counties for road improvement during the past two years bond issues amounting to approximately $13,000,000. This is probably the largest expenditure per capita for road improvement in any state in the Union.

In this connection, however, it is well to point out that the $13,000,000, has been authorized by less than 50% of the counties of the state. Five counties have each bonded for $1,000,000 or more. Bond issues are now pending in several counties, with good prospects of being authorized, and there is every probability that nearly, if not quite $10,000,000, additional in county bonds for road improvement will be authorized during the coming two years.

Road Improvement in Pangasinan Province, Philippine Islands

The Province of Pangasinan is situated in the great plain of the Island of Luzon, the largest of the Philippines. It lies on the westerly side of the island about a hundred miles north of Manila Bay.

The Agno River flows southwesterly and then northwesterly through the central part of the province, emptying into Lingayen Gulf. The river follows a constantly changing meandering course and is subject to overflow in flood season with much damage to roads and bridges. Two other rivers, the Bued and the Tagumusing, also flow through the province into the gulf, both of them being sources of danger to the roads at certain seasons.

Pangasinan was the first province in the islands to build a macadam road, a collapsible bridge and a reinforced concrete pile and girder bridge, according to a recent article descriptive of the public works of the province. The article was written by C. S. Dandois, Assoc. M. Am. Soc. C. E., District Engineer of the Philippine Bureau of Public Works, and was printed in the bureau's "Quarterly Bulletin." At present the province ranks first in mileage of first-class roads. On June 30, 1916, there were 251.3 kilometers, an increase of 214 kilometers since 1908. All of these first-class roads have been built in accordance with the standards adopted by the Board of Public Works. The surfacing in most cases is 4 meters in width and 20 centimeters in depth, after rolling. It is composed of hard gravel or broken stone, with a sodded shoulder on each side. The provincial road system also includes 100 kilometers of surfaced second-class roads, all capable of carrying automobile traffic, and nearly 100 kilometers of third-class roads, suitable for cart traffic, only during certain seasons. The roads of the province are said to form the most complete highway system in the Philippines, as of the 46 municipalities 38 are connected by automobile roads and all but one can be reached by second or third-class roads.

WATER BOUND MACADAM ROAD IN THE PHILIPPINES—THE LINGAYEN-BINMALEY ROAD, PANGASINAN.

Road metal is obtained from the provincial crushing plant near Domalandan on the Agno River. The quarry is situated near the head of a small canyon at the foot of a deposit of andesite rock. The material quarried is conveyed by gravity to the crusher platform and after crushing drops into cars which run by gravity to the river, where they are dumped directly into barges. The barges are poled through the estuaries and unloaded directly on or near the roadsides.

The Los Angeles Municipal Asphalt Plant is reported to have effected a saving to the city of approximately $30,000 during its first year of operation. Over 10,000 cu. yds. of material were turned out during the period from April 17, 1915, to March 30, 1916.

VIEW ON THE SALASA-AGUILAR ROAD—A ROAD OF THE FIRST CLASS IN PANGASINAN PROVINCE, P. I.

Administration of Road Affairs in Indiana

A very full discussion of the highway situation in Indiana is contained in a recent bulletin of Purdue University. The bulletin, which is entitled "Some Factors in the Indiana Road Problem," was prepared by George E. Martin, C.E., Assistant Professor of Highway Engineering in the university's civil engineering department. It covers the organization of the county and township highway departments, road mileage, the topographical, climatic and soil conditions throughout the state, the occurrence of road building materials, the traffic upon the highways, and the method of financing road work.

It is generally known that Indiana has for a long time been conspicuous as an example of the principle of local control carried to the extreme. This is pointed out by Prof. Martin in his conclusion, and he also points out that the state "seems to have reached the parting of the ways in the solution of her road problem." According to Prof. Martin, the results of the method of control obtaining in Indiana have been good in the past, and the state can be proud of its local road system. He points out, however, that conditions are rapidly changing, that roads entirely satisfactory 10 years ago are now inadequate to the traffic they have to carry, and that road building is rapidly changing from the application of rule of thumb methods to its proper place as one of the engineering sciences. He also calls attention to the fact that since federal aid is now obtainable, and the government will not deal with anything but a state, some form of central organization will be necessary to secure federal appropriations.

In view of past and present conditions in Indiana the sections of the bulletin dealing with the administration of road affairs in the state are of particular interest. Those sections are as follows:

"New Roads—Newly improved roads in Indiana are now built under a dual organization. The people of a township originate the action by petitioning for a road. The board of county commissioners considers the petition and may appoint two viewers and an engineer, and order a survey and estimate of cost. In general an election is ordered after the report of the engineer and viewers has been received. Only freeholders of the township may vote and the road must carry by a majority of the votes cast. In case the election is lost the petitioners must pay all of the costs. If the election carries the board of county commissioners advertises for bids and lets the contract for the construction of the road.

"The commissioners also issue bonds on the township to pay the cost of the road. The amount of bonds issued is limited, by law, to 4% of the valuation of the township. The bonds may be for any term under 20 years and pay interest at the rate of 4½%. Taxes are levied on all of the property of the township to pay the principal and interest of the bonds.

"The board of county commissioners has charge of the construction of the road. It appoints a resident of the township as superintendent of construction, who receives $2 per day for his services.

"If the proposed road is not over 3 mi. long and connects at each end with an improved road or a corporation line, the board of county commissioners may order its construction without an election. This is the so-called 'Three Mile Road Law.' For roads built under this clause the procedure differs only in that no election is necessary.

"Many roads have also been built by the district road supervisors. Some excellent roads have been obtained in this manner, although very poor methods of construction have been used in many cases.

"While a most excellent system of local roads has been built up under the present system of road construction, it has some defects, and because of these, sometimes fails to meet present conditions. Many roads have been constructed without any consideration of the proper type. The personal preference of some prominent men has had more weight than the various physical factors that should govern this choice.

"The restriction of the board of county commissioners to a resident of the township in the selection of a superintendent of construction, and to $2 per day for his compensation, has often made it impossible to obtain a qualified man for the position. As a result, the township was forced to permit a man who knew nothing of highway work to supervise its road construction. When only gravel roads were built, probably no great amount of harm was done, but with the advent of higher types of construction, requiring a more careful and rigid inspection, it has become a very serious matter.

"Road Maintenance.—The accompanying figure is a diagram showing the organization for maintaining the township and county roads of Indiana at the present time.

"The roads are divided into two classes, township roads and county roads. County roads are those which have been built under contract, purchased from toll road companies, and roads which have been made county roads by petition. All other public highways are township roads. Each class of roads is maintained by a separate organization.

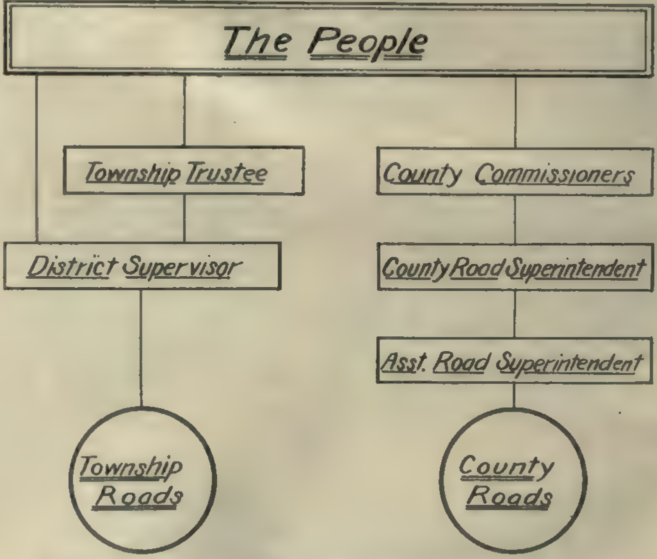


CHART SHOWING THE ORGANIZATION FOR ROAD MAINTENANCE IN INDIANA COUNTIES AND TOWNSHIPS.

"Township Roads.—A township trustee is elected in each township and has charge of the maintenance of the township roads in his township. District road supervisors are elected by the people of the several road districts of the townships. The law limits the number of road districts in a township to four. Where a large proportion of the roads are improved there will be less than four road supervisors to a township. The road supervisor directs the work of maintaining the township roads of his district under the supervision of the township trustee.

"The road supervisor calls out for work on the roads all male persons in his district over 21 years of age and under 50 years of age. He may require them to work for not less than two nor more than four days between April 1 and November 1. This does not apply to residents of incorporated towns. The supervisor chooses the time and place of the road work. A citizens may pay to the supervisor $1.50 per day for each day that he is supposed to work. The supervisor then hires other labor with this money. If a man works with a team he is allowed two days for each day he works.

"In addition to this the township trustee may, with the consent of his advisory board, make a levy of not over 30 ct. per $100 for road repairs. The advisory board consists of three members elected by the people of the township. The money from this levy is paid into the county treasury and then is paid to the trustee who expends it. Any taxpayer may work out $20 of this tax on the roads if he so desires. For this work he is credited with $1.50 per day.

"County Roads.—The county road superintendent has direct charge of the maintenance of the county roads. He may appoint one assistant for each 25 mi. of county road. All of the labor on the county roads is paid for in cash.

"The county road superintendent recommends to the board of county commissioners the amount of the tax levy for county road repairs and maintenance. They in turn recommend the tax levy to the county council, which body actually makes the levy. The county council consists of seven members elected by the people. This levy can not be more than 10 ct. on the $100 for every 100 mi. of county roads. The money is paid into the county treasury.

"The automobile license fees are also used for the maintenance of county roads. They are paid into the state treasury. After the expenses of collection are deducted the money is returned to the counties. The fund is divided into three equal parts. Each county receives an equal portion of one part. Another third is divided among the counties in proportion to the amount which they have paid in. The remaining portion is paid to the counties in proportion to the number of miles of county roads which they possess. If the portion of the automobile fund paid to any county exceeds $100 per mi. of county roads in that county, the excess is deposited in the county treasury to the credit of the township roads. The fund is divided among the townships in proportion to the number of miles of township roads which they possess.

"The material which is placed on the township roads is purchased by the township trustee. In most counties the repairing material for county roads is purchased by the county road superintendent with the approval of the county commissioners.

"While our maintenance organization has been improved in the past few years, there are still too many officials for the work to be done and much divided responsibility."

Resurfacing an Old Wayne County Concrete Road With New Concrete*

Grand River Road was selected for this experiment because we felt that it would receive the severest kind of test, on account of the heavy mixed traffic which uses this highway and because the section selected was rough and uneven.

This section of road was built by the Owosso Construction Co., of Owosso, in 1910, and is of 2-course construction. It is 6½ in. thick, 16 ft. wide—built on a crowned subgrade. The bottom course is a 1:2½:5 mix, using crushed limestone for the coarse aggregate, 4 in. thick. The wearing course is a 1:2:3 mix, 2½ in. thick, using crushed field stone ranging in size from ¼ to 2½ in. for the coarse aggregate. It was put down in 25-ft. sections with ¼-in. tar paper strips cutting entirely through the concrete. The surface was struck off with a template and was somewhat irregular in finish as we were not as careful and as thorough at that time with regard to finishing as we are at present. The edges of the road were rounded off with about a 3-in. radius (a practice we have since abandoned). During the week of Aug. 17, 1912, 7,444 vehicles passed a given point on this road, and during the week of Sept. 18, 1912, 7,580 vehicles, by actual count, passed the same point, which is near where we resurfaced the road. Forty-plus per cent of these vehicles were horse-drawn, the balance being motor-driven. This territory has been built up rapidly since the above traffic count was taken, and an actual count at the present time would undoubtedly show a very material increase in the number of vehicles passing a given point. To better accommodate this increased traffic, we decided to widen the road to 20 ft. In order to do this, we broke off the rounded edge and added concrete on each side of the old road to bring it out to the required width. A 1:2:4 mix, 6 in. deep, of washed and screened pebbles and washed and screened sand, of the same quality as provided in our standard specifications, was used.

All the Tarvia surfacing and filling used to cover the cracks

OLD CONCRETE ROAD WIDENED TO 20 FT.—GRAND RIVER ROAD, WAYNE COUNTY, MICHIGAN.

APPLYING TARVIA ON MOISTENED CONCRETE ROADWAY IMMEDIATELY BEFORE PLACING CONCRETE.

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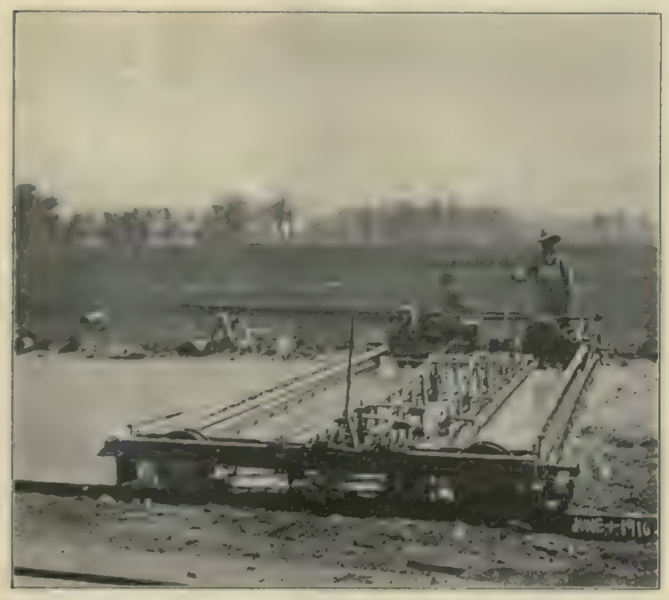
*From the tenth annual report of the Board of County Road Commissioners of Wayne County, Mich.; dated Sept. 30, 1916.

PLACING CONCRETE RESURFACING—SHOWING REINFORCEMENT—GRAND RIVER ROAD.

was removed. The cracks and holes were then filled with concrete to make an even surface 20 ft. wide. The expansion joints, as steel protection plates were not used, were mostly worn down. Where the joint was spalled to a considerable extent, the old concrete was broken away sufficiently to give a bond for new concrete on both sides of the joint. Expansion felt was then placed and the whole surface brought up to an even grade. On the top layer of this base we placed a 3-in. layer of 1:1½:2½ concrete, using Marquette, Mich., trap rock, graded in size from ¼ to 1 in., for the coarse aggregate, and washed and screened bank sand for the fine aggregate. The surface in no place is less than 3 in. thick, reinforced with No. 26 triangular-mesh wire. We did not try to bond the top course to the old road with a rigid bond. The surface of the old concrete was first sprinkled with water, after which a mixture of Tarvia A and Tarvia X was sprinkled on, hot, with an ordinary sprinkling can, immediately before placing the new wearing surface. The Tarvia, falling on the moist concrete, spread in a very thin layer and was immediately chilled, thus forming an even coat over the old surface. The expansion joints in this top course coincide exactly with the expansion joints in the bottom course. A piece of wood, 3x4 in., 20 ft. long, was laid over the old joint, and the concrete deposited as though no joint were to be made. A Baker automatic finishing machine was used to finish the surface. Afterward this piece of wood was removed, and armor plates suspended from installing bars, with expansion felt, were set into place on the side forms—the felt of the new joint meeting the tar paper of the base joint. We believe this method to be better than pouring the top course directly on to the bottom one, as a slight movement, due to difference of expansion or heaving, would result in cracks to the top course, if they were rigidly bonded together. The Tarvia, although very thinly spread, permits a slight movement of each course without interfering with the other.



FINISHING ROAD SURFACE WITH A BAKER AUTOMATIC FINISHING MACHINE.

Before approving of this type of construction, small slabs of concrete were made, a coat of Tarvia put on top and another course of concrete deposited. It was found not only impossible to separate these two layers, but a blow on the upper, sufficient to crack the top course, would also crack the bottom one. The road was covered in the regulation manner, to hold the moisture, and sprinkled daily for two weeks. Traffic was permitted to use the road 25 days after the last concrete was placed.

The cost of this work, $15,573.67, is high, due to conditions at time work was undertaken, and should not be regarded as a factor in this particular instance, as it was the determining of a principle that was being undertaken. If the principle is correct, the working methods can be perfected to bring the cost down where it belongs.

This section of road has been in use about four months, and to date is apparently successful. A much longer period of time must elapse before we can make a positive statement as to its success.

While the road was closed during the construction of this experimental section, we provided a good detour which took traffic only a short distance out of its regular course, and it was necessary to use considerable quantities of crushed stone to put the detour in a fair condition.

We believe it wise to add a word of caution that this resurfacing is regarded by us as wholly in the nature of an experiment which should be watched and studied, rather than generally advocated, until it has proven itself out.

Operation of Motor Vehicles at Railroad Grade Crossings was the subject of discussion at a recent conference at Washington, participated in by representatives of the National Association of Railway Commissioners, the American Automobile Association, and the American Railway Association. The purpose of the meeting, according to the A. A. A., was the adoption of a uniform system of signals and other precautionary measures. Unanimous agreement was had, according to the report, as to the type of first warning sign to be erected, and also as to its location, the latter being fixed at 300 ft. from the crossing. The greater part of the discussion at the meeting was devoted to the question of whether the operators of motor vehicles should be compelled to come to a full stop before crossing a railroad at-grade. According to Chairman O. I. Yellott, of the A. A. A. Legislative Board, two propositions were suggested by the spokesmen of the railroads: The first provided that within 100 ft. of a crossing a motor vehicle should not go faster than 10 miles an hour; the second provided that a motor vehicle should be brought to a full stop not less than 10 ft. from the nearest rail of the crossing. The first suggestion was objected to on the ground that it was unreasonable and would tend to give rise to the maintenance of obnoxious speed traps at such crossings. The second was objected to mainly on the ground that it was unreasonable to require motorists to stop at all crossings, since in many instances the tracks in either direction were visible for such distances as to make stopping entirely unnecessary. It was finally agreed that motorists should be required to reduce speed and proceed cautiously at all crossings, and that the public service commissions or railroad commissions of the several states should have the power to determine the crossings at which it was reasonably necessary that stops be made; such full stop crossings to be designated by appropriate signs, and the failure of a motorist to stop at such to be prima facie evidence that he had not proceeded cautiously in making such crossing.

GOOD ROADS

A Weekly Journal of Road and Street Engineering and Contracting.

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Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

JANUARY 6, 1917

RESURFACING CONCRETE WITH CONCRETE

An experiment that will be watched by highway engineers with unusual interest is the resurfacing of a cement concrete road in Michigan with the same material. The work was done on Grand River road in Wayne County and is described in detail on other pages of this issue.

Ever since the all-concrete road has been in use there have existed decided differences of opinion among road builders as to the durability and suitability of the surface it presents to traffic. In many places it has been put down with the expectation that it could be maintained satisfactorily and economically as an all-concrete road for a period of years and then covered with a wearing surface of some other material. The structural advantages of such a utilization of cement concrete are obvious, especially in view of the need for strong and lasting foundations to support the ever-increasing weight of modern traffic. The proposition is no less attractive from a financial standpoint. With the up-to-date machinery available and the developments that have come in the technic of construction, the concrete pavement can be put down at a comparatively low cost. The work of resurfacing it later would also call for a relatively small outlay and the performance of the two operations several years apart would distribute the cost.

If the Wayne County experiment proves successful it will demonstrate the feasibility of an alternate method of treating a worn-out cement concrete surface. With further experiment and the collection of cost data on resurfacing with concrete, it will be possible to determine with a fair degree of accuracy the best and most economical method of utilizing the concrete pavement. All of this will take time, but when done will mark a long forward step in the road builder's art.

It is to be hoped that the Wayne County experiment will be followed by others along similar lines and that sufficiently detailed records, including costs, will be kept to make the experiments of practical value.

"GOOD ROADS"—PAST, PRESENT AND FUTURE

Exactly five years ago, in the issue of January 6, 1912, a brief resume of the advances made in highway betterment during the twenty years preceding was printed in these columns under the caption "Our Twentieth Anniversary." As that issue marked the beginning of the twenty-first year of the continuous publication of "Good Roads" occasion was also taken to trace the development of the magazine from the official monthly bulletin of the League of American Wheelmen to the place it then held—and now holds—as the leading publication in its field and the only one devoted exclusively to the interests of road builders.

"Good Roads" has now completed a quarter of a century of service to its readers and at the opening of its twenty-sixth year it seems fitting to again look back over the accomplishments in the road building and street paving fields. Many changes have been made in the methods of financing and administering highway affairs; new methods have been developed; new materials have found places. With all these changes "Good Roads" has kept abreast, striving always to gather and put before its readers the best thought of the leaders in its own particular field.

Space permits only the briefest survey of the achievements of road builders during the years since January, 1892, when the first issue of "Good Roads" made its appearance. At that time the state aid principle had not been applied in a single instance. New Jersey had passed a state aid law the previous year, but it did not become operative until amended some time in 1892. Within a few years the plan had been adopted by Massachusetts, Connecticut and New York, and during the years following state after state fell into line. At present few states remain in which some form of state aid is not in force, and in these few it seems probable that action will be taken before the close of 1917. Federal aid has also become a fact within the past year so that now the nation and the states are participating in a work that in the beginning was carried on solely by counties, cities, towns and districts.

Readers of "Good Roads" are familiar with the causes of the good roads movement, so-called, and need only to be reminded of the factors responsible for the present demand for improved roads—first the bicycle, then the automobile—both pleasure vehicles at first—and finally the realization of the economical importance of a well developed primary transportation system that has come with the development of the commercial vehicle. "Good Roads" grew out of the first of these, for it was started by the League of American Wheelmen to forward the propaganda carried on by that organization. It remained the official organ of the L. A. W. for some years and continued to be a popular magazine devoted almost exclusively to the advocacy of road betterment until it was purchased by the present publisher in April, 1902.

At that time, "Good Roads Magazine," as it was then called, was a monthly publication of about thirty pages 6½ x 10 in. in size. During the years since then many changes have been made in the appearance, arrangement and style of the magazine, and in the character of its subject matter. In January, 1907, the page was enlarged to its present size for the double purpose of making possible better illustration and of conforming to the general practice of class journals. With the gradual change from a popular magazine leading the good roads movement to a class publication for the builders of roads, less and less attention has been paid to the propaganda phase of road betterment and more and more to the technical, practical problems of road building confronting officials, engineers and contractors. For the special benefit of the last named, there was inaugurated in June, 1908, a contract news service. This was furnished by distributing weekly mimeograph sheets of notices of bids wanted and contracts awarded. On Jan. 1, 1910, this was replaced by the publication of a 9 x 12-in. printed sheet carrying a largely increased amount of news. One year later this

"Contract News Supplement," as it was called, was increased to a 4-page publication issued weekly and carrying besides contract news, items of general news and advertising. Four more pages were added to this with the issue of June 10, 1911, and "Good Roads" became a weekly publication, the first issue of the month, however, following the lines of the previous monthly magazine.

In addition to these changes in form there has been a continuous development of the publication, the single purpose having been to make it of the maximum practical value to those engaged in highway work, either in the country or in cities, as officials or engineers in state, county, town or city highway departments, or as contractors in road, street or bridge work. To this end every effort has been made to present to its readers the important news in the highway field, including road legislation, the activities of good roads and kindred organizations, and other matters of interest, as well as special technical and descriptive articles, papers presented at meetings and other articles measuring the progress of the science and art of highway construction and maintenance.

With this issue still further changes are made. Hereafter technical matter as well as general and contract news will be printed in all issues. Heretofore only the issue of the first Saturday in each month, as a rule, has contained special articles, papers and other technical matter, the contents of the other issues having been confined almost entirely to current news. From now on there will be no distinction between the issue of the first Saturday of the month and those of other Saturdays, all issues carrying technical articles and general and contract news. These changes have been decided upon to make possible the better presentation of matters which "Good Roads" feels its readers desire to have placed before them. The result of these changes, so far as the reader is concerned, will be to make available to him a larger amount of text during the year and its more timely presentation.

Today "Good Roads" stands alone as the only weekly publication devoted exclusively to the problems of highway officials, engineers and contractors. Its success is due very largely to the hearty cooperation of those engaged in highway work, and at this time when twenty-five years of service have been completed and "Good Roads" is starting upon a new year, it wishes to extend to its readers its thanks and to bespeak a continuation of their support. The policies which have been followed in the past will still govern, and no effort will be spared to make "Good Roads" of greater and greater practical value to all those engaged in highway work or who are interested actively or otherwise in road betterment.

ARTICLES BY ROAD BUILDERS

For several months "Good Roads" has printed on the editorial page a paragraph inviting the submission of articles by engineers, contractors and others engaged in road and street work. The results have been pleasing, and as a part of the publisher's program for making the magazine of even greater value to its readers this year than it has been in the past, the invitation is repeated here.

For reasons which are sufficiently plain, a man engaged in any line of work is anxious to learn how other men have done the things he is called upon to do. Few men are so proficient, even in their specialty, that they have nothing to learn and this is notably true of an art such as road building which, in a way, is still in a formative stage. Personal inspection of other men's work and conferences with others are possible only to a limited extent, so that it becomes one of the chief functions of the class journal to put before its readers the experiences of men working in the field it covers. While the editorial force does collect and compile data for certain kinds of articles, it can not have a detailed knowledge of more than a relatively few of the more important pieces of work. Because of this it can not prepare all of the special articles required, and it becomes necessary to use articles by the men on the work. Moreover such articles have the added value of giving first-hand information.

It is somewhat surprising that although the average engineer appreciates the worth of contributed articles he is slow to realize that he himself is in a position to write them. In the first place, his intimate knowledge of his own work prevents him from correctly estimating its importance. Possibly he is solving some problem of organization, construction or costs in an entirely original way. If so, he is very likely to minimize the merit of his solution because it is merely a commonplace detail—to him—or, sometimes, because of an innate modesty that leads him to underrate his own achievements.

Another factor having much to do with the engineer's failure to recognize the interesting and valuable features of his own work is a failure to realize the significance of details. A man in charge of heavy grading might rightly argue that there was nothing of great interest in taking several thousand cubic yards of rock out of sidehills and using it to fill the hollows along the right of way. But some small part of the work that appeared trivial, as "incidental work," might, if considered by itself, prove of exceptional interest to another engineer.

Probably the reason most frequently advanced for not embodying in an article the fruits of experience is the engineer's inability to "write." It is the poorest as well as the commonest excuse. In the first place, the editors of technical journals judge contributed matter not as literature, but on the information given. Having found this satisfactory, it is one of the duties of the editorial staff to see that the facts and figures are presented clearly and in a readable style. With this part of the preparation of an article the engineer need trouble himself but little.

Too many articles by those engaged in the work of building and maintaining highways both in urban and rural districts can not be secured. "Good Roads" receives many, among them, unfortunately, a considerable number not available for publication, but it desires to get more, and asks the cooperation of its readers.

TOWN AND COUNTRY ROADS

The Good Roads Magazine told the story about the large business center in Vermont where the roads in the municipal center were in much worse condition than those in the county towns adjoining, and then Brattleboro, Bennington and Rutland put the mythical coat on because it fitted.—*Brattleboro (Vt.) Reformer.*

No, the large business center about which the story was told was not in Vermont, nor in Pennsylvania, though both have been heard from. Moreover, it is not a "mythical" coat but a very real garment—to continue the figure. The "story" referred to—"The Streets of Small Cities and Large Towns," an editorial in "Good Roads" for Aug. 5, 1916—accurately described the conditions in a certain large town and might have been written of hundreds of others.

Asphaltic Concrete of Special Composition is being used in extensive paving work in progress at Oak Park, Ill., one of the principal suburbs of Chicago. The mixture is a modification of Topeka, but contains a larger proportion of coarse aggregate. The approximate proportions, by weight, are as follows: Crushed limestone, 50 per cent.; sand, 36 per cent.; stone dust, 7 per cent., and asphalt cement, 7 per cent. The specifications for the crushed stone call for a material such that 100 per cent. will pass a ½-in. sieve and not more than 40 per cent. will be retained on a ¼-in. sieve. At least 65 per cent. of the stone dust must pass a 200-mesh sieve. An asphaltic cement that meets the specifications of the American Society of Municipal Improvements is required. The hot mixture is laid on a concrete foundation in sufficient amount to form a 2-in. course after compression.

Labor Shortage in the South

(Contributed)

For the first time in a good many years there is an exceptionally serious shortage of labor in Dixie. The labor shortage in the North, East and West has resulted in a large percentage of the negro labor of the South being transported to other sections of the country, and this is interfering with southern construction work to a greater degree than is generally known. This is being manifested particularly in the street paving and road building line and water power development work. Street paving and road building contractors in Florida and in the southern parts of Georgia, Alabama and Mississippi, which is the only part of the South where work of this character can be profitably performed during the winter, are experiencing severe and costly delays on account of inability to properly man their work.

An unfortunate phase of the situation is that the labor agents from other sections have been successful in securing the best of the labor, and that which is left is below par in efficiency and constantly demanding wage increases. This class of labor likewise refuses to remain continuously employed, a fact which is costly to the work from the contractors' viewpoint. Some of the principal southern contractors are considering a cessation of new operations until the labor market becomes more settled. Just when this adjustment in conditions may occur no one seems willing to hazard a guess.

Sand-Asphalt Roads in Florida

A subscriber who is a member of a northern contracting firm has recently sent us a letter from the editor of a Florida newspaper describing sand-asphalt roads in that state. The following are extracts from the letter, which space does not permit us to print in full:

"You rightly supposed I would be interested in the article on 'Sand-Oil Roads in Massachusetts,' as described by W. R. Farrington, in 'Good Roads' for Nov. 4, 1916. I read the article with pleasure. In the light of our experience with that type of road (sand-asphalt), the article reads as if it had been written in Eustis. It is fair, very free from extremism, and thoroughly informing. I have written so much in favor of this type of road, spoken so often for it, and so thoroughly believe in it, that I am not in need of anything but a supply of patience with the doubting Thomases who hold between it and other types. * * * Now that this commissioners' district contains some twenty miles of it, and this city is completing 54 blocks of it, I am getting indifferent to what the dunces of other sections are doing in the matter of road materials. We know we have the best, cheapest and smoothest road for double its cost in Florida. With a 6-in. clay base and 3-in. hot-mixed, rolled sand-asphalt top, we find it cost our county, exclusive of grading, less than 70 ct. per sq. yd. Our city has laid it on a 4-in. concrete base in the fire limits downtown, and on rolled crushed rock elsewhere. * * *

"This brings me to the recollection of your speech urging us at our very first good roads meeting here in 1912 or 1913 to bond the county for sand-asphalt roads. (Am I wrong?) We sent commissioners to the very places described in 'Good Roads.' They returned with but one opinion: 'Successful and advisable—but costs more than our original estimate, 30 to 40 ct. per sq. yd.' Undismayed, we called bond election for entire county, for $500,000 for sand-asphalt roads for Lake County, Florida. The bonds were voted and then four of the five district commissioners balked on spending 66 to 75 ct. per sq. yd. for sand-asphalt. * * * John S. Lane, of Meriden, Conn., an old road constructor, laid a sand-asphalt road 18 ft. wide and 600 ft. long in this city, and died—leaving it to the city as a monument to his revered memory. That strip of heavily-traveled road in front of the famous Ocklawaha Hotel has revolutionized road building in Florida. It has been inspected by thousands and visited again and again by critics and experts. One gentleman has made eleven pilgrimages from Lakeland, Fla., 100 mi. distant, during the four years the road has been in constant service without a cent of repairs. And when that gentleman's great county of Polk agitated for road material, it bonded last summer for one and a half million dollars to build the Eustis-John Lane sand-asphalt 'velvet way,' 240 mi. of it! I think, as I say, the world should know through the excellent magazine, 'Good Roads,' just how we solved the vexing question of Florida sand roads. * * *"

Ceramic Engineering Building at the University of Illinois

A new building for the course in ceramic engineering has recently been completed at the University of Illinois at Urbana. It was dedicated on December 6 and 7, an account of the ceremonies appearing in "Good Roads" for Dec. 16.

The building, a general view of which is shown in the accompanying illustration, covers a ground area 189 ft. long and 67 ft. deep. A corridor connects it with a kiln laboratory at the rear. The main building is three stories in height.

The entire basement is occupied by the fan system equipment and by storage rooms. The ceramic materials laboratories, an office and private laboratory, and the concrete testing laboratory occupy the first floor. On the second floor are the offices of the department, offices and private laboratories for two professors, the library, lecture rooms, class rooms, a drafting room, several laboratories for chemical and physical work and a laboratory for high temperature investigations. The third floor is at present occupied by the offices and laboratories of the Geological Survey. Space is also provided for the distilling apparatus which furnishes distilled water to the building.

NEW CERAMIC ENGINEERING BUILDING OF THE UNIVERSITY OF ILLINOIS AT URBANA.

The building is constructed entirely of materials representative of the ceramic arts—brick, tile, terra cotta, cement, and gypsum products. The walls of the main corridor on the first floor are decorated with display panels showing different styles of face brick. These panels were donated and erected by various brick manufacturers of Illinois, Indiana, and Missouri.

The laboatories throughout the building are provided with water, gas, compressed air, vacuum, distilled water and alternating and direct current. The building and equipment for the ceramic engineering department of the university represents an investment of about $200,000. The staff of the

Department of Ceramic Engineering is as follows: Edmund Janes James, Ph.D., LL.D., President of the University; William Freeman Myrick Goss, M.S., D. Eng., Dean of the College of Engineering; Edward Wight Washburn, B.S., PhD., Professor of Ceramic Chemistry and Head of the Department of Ceramic Engineering; Cullen Warner Parmelee, B. S., Professor of Ceramic Engineering; Ralph Kent Hursh, Assistant Professor of Ceramic Engineering; and Howard Clinton Arnold, M.S., Instructor in Ceramic Engineering.

Pavements in Use in Texas Cities

Interesting statistics on the kinds of materials used in paving in Texas cities has been prepared by L. W. Kemp, Manager of the Sales Department of the Paving and Roads Division of The Texas Company, at Houston, Texas. In the table, which is printed below, are given the yardages of the different kinds of pavements within the limits of cities and towns in Texas under traffic Jan. 1, 1916.

Kind of Pavement.	Square Yards.
Bitulithic	2,994,263.33
Standard brick blocks	1,997,453.75
Creosoted wood blocks	1,055,020.96
Asphalt macadam	899,994.10
Asphaltic concrete	750,663.34
Vertical fiber brick	513,125.82
Oklahoma rock asphalt	498,817.14
Sheet asphalt	433,643.15
Uvalde rock asphalt	345,342.63
One course plain concrete	184,585.57
Two course plain concrete	159,678.54
Granitoid	148,886.43
Two course reinforced concrete	94,356.50
Bois d'Arc blocks	78,501.00
Hassam	55,355.12
Granited concrete	44,471.20
Vibrolithic	42,151.40
Westrumite	33,708.93
One course reinforced concrete	22,829.00
Rock asphalt macadam	7,386.00
Dolarway	3,961.40
Belgian blocks	1,768.00
Mesquite blocks	793.00
Total	10,366,756.31

Weather Records of the Department of Public Works of Portland, Oregon

Records which have proved of great value in all lines of municipal work in Portland, Ore., are those of weather conditions kept by the Department of Public Works of that city.

The records are kept on forms showing, for each day, the precipitation in inches, the number of hours of sunshine, the maximum and minimum temperatures, the direction and velocity of the wind, and other relevant information. The general arrangement of the form is shown below:

DAILY REPORT OF WEATHER
as affecting construction and other work of City of Portland
Time—5 p. m. from 5 p. m. of preceding day.

Month	Day (date)	Precipitation in inches	Sunshine		Temperature		Wind		Remarks.
			Hrs.	Mins.	Max.	Min.	Veloc.	Direct.	

The records are used in judging the reasonableness of requests for extensions of time on contracts and for the purpose of ascertaining weather conditions on certain days relative to which there are disputes. The records have been used not only in the department, but also in the courts in actions in which weather conditions have had a bearing on a case. The data are taken from the U. S. Weather Bureau reports.

Research Fellowships at the University of Illinois

The University of Illinois, through its College of Engineering, maintains fourteen Engineering Experiment Station research fellowships open to graduates of approved American and foreign universities and technical schools. One other fellowship is offered under private patronage. Each fellowship covers a two-year course, the yearly allowance being $500. Graduates receive the degree of Master of Science.

Nominations to these fellowships which are based upon the character, scholarship and engineering experience of the applicant, are made by the Director of the Engineering Experiment Station from applications received each year not later than Feb. 1. The appointments are made in the spring and take effect Sept. 1 following. Nine vacancies will occur at the close of the current academic year.

The research work requires about half the time of the student, the other half being available for graduate study. Among other branches of engineering in which research may be undertaken are ceramic, civil, and municipal and sanitary engineering. Full information may be obtained by addressing the Director, Engineering Experiment Station, University of Illinois, Urbana, Ill.

Bond Issue for Improvement of the Sheridan Road

The City Council of Kenosha, Wis., has recently authorized the issue of $45,000 in bonds for work on a part of the Sheridan Road connecting Chicago, Ill., and Milwaukee, Wis.

The proceeds of the bonds will be used for the repair of the stretch of road between Kenosha and the Illinois-Wisconsin state line. This section has been in very bad repair. It is stated that the Sheridan Road Improvement Association will conduct an active campaign this winter to secure appropriations for the paving of the stretch between Zion City and the Wisconsin line, another section which is in poor condition.

Colored Bands on Poles have been adopted to mark state routes in Massachusetts. Main east and west roads are designated by red bands, main north and south roads by blue bands and diagonal and secondary roads by yellow bands. Where main routes in Massachusetts meet similar routes in New Hampshire or Vermont, the designations of each state are carried along the roads for a short distance in the other state.

The Road Testing Machine Used in the Laboratory of the British Road Board is described in considerable detail and comment made on the results obtained with it, in the current report of the Road Board, note of which is made elsewhere in this issue. The machine consists of a revolving frame supported on wheels which run over a track built of the kind of pavement to be tested. A complete illustrated description of it was printed in "Good Roads" for September 6, 1913, shortly after its installation. The method of operating the machine which has been developed is described in the report as follows: "The test proper then commences—the machine is run at a load of 470 lbs. per in. of width, and at a rate of about 2,200 tons per yard of width per hour; the running hours are about 8 per day, the track being kept wet all the time. The condition of the track is observed twice a day or oftener, and any defects which may appear are entered on test sheets. The material worn off by attrition is collected as mud, dried and weighed. In most cases with good material a well laid surface remains smooth and polished and but slightly marked until about 200,000 tons per yard of width have rolled over the track. Generally about this stage, wave-like markings begin to appear. These gradually extend themselves until at 400,000 tons, the surface becomes considerably waved, so that the vibration caused and communicated to the machine and building is excessive, and the test is then considered complete. Plaster casts are then taken to record the shape and the condition of the road surface—usually one of these is taken at the worst point where the surface is most waved, and another at the point where it is smoothest. Test pieces are cut out, and their density compared with the first set of samples so that the increase of density during the test can be recorded."

LETTERS TO THE EDITOR

The Road Mileage of the Russian Empire

Editor, "Good Roads":

I note that in the report of the last annual meeting of the American Road Builders' Association, which was published in your issue of November 11th, an error occurs in the statement of my remarks before the meeting. I am quoted as saying that there are about 40,000 mi. of highway in the Russian Empire, whereas what I did say was that there are approximately 40,000 mi. of railway in the Empire. I did not mention the length of the Russian highways, but I might say that there are about 90,000 mi. of highway in Russia, about 15,000 of which are ballasted.

Would you be so kind as to correct this error in one of your early issues?

Maximilian Groten.

Russian Railways Commission,
New York, N. Y.

[We are very glad to print Mr. Groten's letter to correct the error to which he calls attention.—Ed.]

Relation of Inspector to Contractor

Editor, "Good Roads":

In the process of developing either a public or a private work, various factors, firms and individuals must be considered. The principal, whether an individual or a corporation, furnishes the finance, and the importance of adequate returns for the investment should be considered in each case. The engineer or architect is supposed to represent the principal, but in the execution of the work the contractor is an important factor. His rights should be regarded by the engineer, and each should meet the other in a spirit of fairness.

One of the problems that confront the designing engineer is that of securing the use of such materials as will produce the maximum efficiency. In this the contractor plays an important part. The most carefully prepared design or specification will fail if the right materials are not used with mechanical skill. After the designer has planned a piece of work and the principal has provided the funds for producing it according to the plans and specifications, it becomes the duty of the supervising engineer to get the results called for by such plans and specifications. The supervising engineer occupies the position of a judge, passing upon the results as the contractor presents them in the form of materials, workmanship and completed parts of the project. It is his duty to see that no inferior materials are employed and that the work is being prosecuted according to the intent and meaning of the contract, and to this end it is his duty as inspector, supervisor or engineer to impart such information to the workmen as will enable them to do their work in the most efficient manner.

No man should undertake to perform the duties of an inspector or supervisor if he does not have a complete knowledge of the work proposed and if he is not capable of fairly and impartially deciding upon every phase of the project as it is presented. Many contractors have been required to do unnecessary work because the inspector failed to measure up to the requirements of his position, while, on the other hand, many structures are not up to the highest standard of efficiency because the inspector was not capable of protecting the interest of the principal. To be able to properly judge engineering construction, the inspector must be honest and fair-minded as well as an engineer of training and experience.

A. D. WILLIAMS,
Chief Road Engineer, State Road Bureau.
Morgantown, W. Va.

PUBLICATIONS

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF PUBLIC ROADS AND RURAL ENGINEERING; Annual report for the year ending June 30, 1916. Paper, 6x9 in., 16 pp.

This report covers the work of the Office of Public Roads and Rural Engineering during the fiscal year ending June 30, 1916, including, besides road work, the work on drainage investigations, farm irrigation, and other branches of rural engineering. The portion dealing with roads covers road construction, road maintenance, national park and forest roads, road economics and road material tests and research.

"THE ORGANIZATION OF A STATE HIGHWAY DEPARTMENT FOR THE STATE OF TEXAS," by B. K. Coghlan, Associate Professor of Highway Engineering, Agricultural and Mechanical College of Texas, Bulletin 15, Texas Engineering Experiment Station. Paper, 6x9 in.; 30 pp. and covers.

Included in this bulletin are a brief review of the highway situation in Texas with reference to its bearing upon legislation for the creation of a state highway department, and a proposed law covering the organization of such a department. Explanatory notes are inserted through the law and alternate sections are provided, to take the place of Section 14 in the model bill which provides for financing the department. These sections to be used only if it should be found advisable to have the bill carry with it a provision for a tax on motor vehicles.

MICHIGAN, WAYNE COUNTY, BOARD OF COUNTY ROAD COMMISSIONERS. Tenth annual report for the period from Oct. 1, 1915, to Sept. 30, 1916, inclusive. Paper, 6x9 in., 87 pp., illustrated, inset map.

This report follows the general style of previous reports of the Wayne County commissioners and includes detailed data on the methods and costs of construction of the concrete roads of Wayne County. There are also included the specifications of the board and a chapter recommending certain legislative action. The report is printed on paper of unusually good quality and is profusely illustrated by half-tone views of Wayne County roads before, during and after improvement.

TRACTIVE RESISTANCES TO A MOTOR DELIVERY WAGON ON DIFFERENT ROADS AND AT DIFFERENT SPEEDS, by A. E. Kennelly and O. R. Schurig. Report on an investigation, read before the American Institute of Electrical Engineers at its 33rd Annual Convention at Cleveland, Ohio, June 30, 1916. Bulletin No. 10, Research Division, Electrical Engineering Department, Massachusetts Institute of Technology. Paper, 6x9 in., 30 pp., 1 inset plate; illustrated.

In this report is described a series of tests carried on at the Massachusetts Institute of Technology for the purpose of determining the tractive force, exclusive of internal losses of the vehicle, required to propel a delivery wagon at a constant speed on different types of roads. While a large part of the bulletin is of interest only to electrical and automobile engineers, there are several pages devoted to a discussion of the tractive resistances of different kinds of roads.

PENNSYLVANIA, PHILADELPHIA, BUREAU OF HIGHWAYS, DEPARTMENT OF PUBLIC WORKS. Report on the Oxford Pike Service Test Road. Paper, 6x9 in., 37 pp.

This report consists of a reprint of a portion of the annual report for 1915 of the Bureau of Highways of Philadelphia, and contains a detailed description of the construction of the Oxford Pike service test road, with cost data on each of the several sections. This road was described in a previous issue of "Good Roads" ["An Experimental Concrete Pavement Under Construction in Philadelphia," "Good Roads," Nov. 7, 1914, p. 170]. The report is illustrated by three halftones, one showing a section of the road before the building of the experimental pavements, the second showing the work in progress, and the third the completed road.

MEETINGS

Calendar of Coming Meetings

January 16-18.—Virginia Road Builders' Association—Sixth annual meeting, Norfolk, Va. Secretary, C. B. Scott, Richmond, Va.

January 17-20.—County Road Engineers Association of Kentucky—Meeting, Bowling Green, Ky. Secretary, F. L. Duffy, Frankfort, Ky.

January 18-20.—Idaho Society of Engineers.—Eighth annual convention, Boise, Idaho. Secretary and Treasurer, Ira F. Shaffner, Boise, Idaho.

January 20.—Western Paving Brick Manufacturers' Association—Meeting, Kansas City, Mo. Secretary, G. W. Thurston, 416 Dwight Building, Kansas City, Mo.

February 5-9.—American Road Builders' Association—Fourteenth Annual Convention; Seventh American Good Roads Congress under the auspices of the A. R. B. A., and Eighth National Good Roads Show of Machinery and Materials. Mechanics' Hall, Boston, Mass. Secretary, E. L. Powers, 150 Nassau Street, New York, N. Y.

February 7-15.—Tenth Chicago Cement Show—Coliseum, Chicago, Ill. Secretary, Blaine S. Smith, 210 South La Salle street, Chicago, Ill.

February 8-10.—American Concrete Institute—Annual meeting, Hotel LaSalle, Chicago, Ill. Secretary, Harold D. Hynes, 1418 Walnut Street, Philadelphia, Pa.

February 19-24.—Southwestern Concrete Association—Annual meeting and show, Kansas City, Mo. Chairman of committee, Charles A. Stevenson, 1433 West 10th St., Kansas City, Mo.

The Burlington Way Association will hold its sixth annual convention at Springfield, Ill., on Aug. 13 and 14, 1917. The members of the association will be entertained by the Springfield Motor Club.

As noted elsewhere the eighth annual convention of the Idaho Society of Engineers will be held at Boise on January 18, 19 and 20. Among the addresses and papers scheduled for presentation are "The State Highway System of Idaho and the Past Year's Work" by E. M. Booth, State Highway Engineer of Idaho, and "Roads," an illustrated address by J. B. Marcellus, District Engineer, Portland Cement Association.

Southwestern Concrete Association

One day of the coming convention of the Southwestern Concrete Association at Kansas City, Mo., Feb. 19-24, will be devoted to the consideration of road work. Saturday, Feb. 24, has been designated as "good roads day" and a program has been arranged which includes addresses and papers as follows:

"Missouri Roads," Frederick D. Gardner, Governor of Missouri; "Road Laws," Bailey Waggener, Atchison, Kan.; "The Automobile and the Road," E. E. Peake, Secretary, Kansas City Automobile Club; "Concrete Road Design," A. N. Johnson, Consulting Highway Engineer, Portland Cement Association, with discussion by J. B. Marcellus, District Engineer, Portland Cement Association; "Kansas Roads," Arthur A. Capper, Governor of Kansas; "National Old Trails," Judge W. E. Lowe, President, National Old Trails Association; "The Banker and Permanent Roads," R. M. Sawhill, Glasco, Kansas; "The Maintenance of Concrete Roads," George A. Ricker, Portland Cement Association; "The Road System of Wayne County, Michigan," Edward N. Hines, Chairman County Board of Road Commissioners, Wayne County, Mich.

Oklahoma Society of Engineers

At the annual meeting of the Oklahoma Society of Engineers, held at Tulsa, Dec. 27 and 28, officers for the coming year were elected as follows:

President, Alfred Boyd, Dean of Engineering, A. and M. College, Stillwater, Okla.; First Vice-President, Max L. Cunningham, State Engineer, Oklahoma City; Second Vice President, Frank B. King, Corps of Engineers, Lawton; Third Vice President, T. P. Clonts, County Engineer, Muskogee; Secretary-Treasurer, H. V. Hinckley, Consulting Engineer, Oklahoma City.

PERSONAL NOTES

C. D. Conkey has resigned the position of Assistant State Highway Engineer of Carlton County, Minnesota, and it is stated will leave in January for the Isle of Pines.

Julian C. Feild & Co., of Denison, Texas, have been retained by the Ardmore Oil Fields Transportation Co. to make surveys and report on a proposed toll highway extending northwesterly from Ardmore, Okla., to the Healdton and Fox oil fields.

Capt. John Craft, State Highway Commissioner of Alabama and one of the leaders in the good roads movement in that state, met with an accident recently in which he suffered a compound fracture of the left arm and other injuries. According to the latest advices, Capt. Craft is rapidly recovering.

James C. Travilla of St. Louis, Mo., has joined the organization of the Dunn Wire-Cut Lug Brick Company of Conneaut, Ohio, as consulting engineer. Mr. Travilla was at one time Street Commissioner of St. Louis, Mo., and later had charge of the expenditure of $1,000,000 for road work in Tarrant County, Texas.

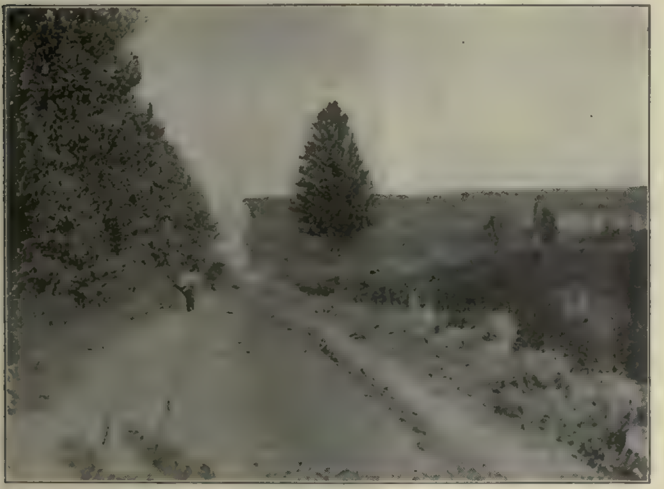
EQUIPMENT — TRADE — MATERIALS

Cheaper Excavation

(Contributed)

Contractors and engineers generally are feeling the acute labor shortage, especially of the cheaper labor used in excavation in road and other work. The number of newly arrived immigrants from which the supply for this class of labor was largely drawn has been very materially affected by the European war. This same cause is largely responsible for the demand for skilled laborers like machinists and iron and steel workers, and the interest shown by manufacturers in drawing upon and training the unskilled men to fill their needs. In addition, the payment of increased wages to skilled workers has caused a general feeling of unrest in labor circles, which, coupled with the constantly increasing cost of living and the insufficient supply of ordinary labor, has caused the demand for higher wages.

In general excavation work labor forms a very important part and one of the most variable items of cost entering into the contractor's or engineer's estimate on a job. Hence, they are looking for and quickly seize upon any good method of saving labor, frequently developing or adapting ways and means to their needs which have been very successful in keeping down costs and enabling them to "break even" on their bids.



BLASTING BOWLDERS OUT OF A DELAWARE HIGHWAY WITH DYNAMITE.

BLASTING CLAY IN A SIDEHILL CUT ON A PENNSYLVANIA ROAD.

One of the chief of these is the development and use of the lower grades of dynamite, which is rapidly finding favor among men in this line of work. In rock, the efficiency and necessity of using dynamite has long been recognized, but when this high grade explosive is used in earth excavation work the results are far from satisfactory. This is due to the character of the material being worked, rock requiring a quick-acting, shattering force to give results, while in earth a slower-acting and heaving or lifting effect is desired. Recognizing the necessity for an explosive of this kind, the manufacturers have worked out a low-grade, slow-acting, heaving, comparatively insensitive and safe to handle low-freezing dynamite which contractors have been quick to adopt in their search for an efficient means of cutting down labor costs. It is used in conjunction and in combination with all types of mechanical excavators to hasten, aid and cheapen the work, doing the firing at a time when it will not interfere with the other operations.

On large projects, even where the steam shovel is used, it is generally necessary to loosen the material by blasting ahead of the shovel where large imbedded boulders, compacted earth, or hardpan are encountered. In order to secure the maximum efficiency of the machine, the shovel must be filled at every trip, hence it is not advisable to make the shovel do very much digging in hard material, as the yardage handled will be too low for any profit. Often the use of a little dynamite on large bowlders, old water mains, large roots, stumps and other obstructions will save a broken cable and consequent delays. On work such as excavations for bridge piers, where the holes in dry ground are comparatively deep and of small area, good results can frequently be obtained by loosening up the bottom with blasts and removing by means of a clamshell or orange-peel bucket.

For smaller operations or on those which, by their nature, do not permit of the use of the more expensive large machinery, but depend more on some sort of plowing to loosen the material, the amount of hand labor required is greater and hence there is more necessity for the use of labor-savers. In shallow excavations where the material is not too hard to plow successfully and where ample room may be had in which to turn, the horse- or tractor-drawn elevating grader gives good results. The use of the wheeled scraper, buck scraper, slip, and "Fresno" scrapers are limited to very soft material, hence plowing to loosen the material is essential. In hard ground, or where there are bowlders, roots, stumps or hardpan, plowing becomes very unsatisfactory and costly, and sometimes, impossible. By the proper use of dynamite the plowing may be dispensed with entirely at a considerable saving, and, even in easily plowed ground, where it is desired to leave the banks and corners of the excavation perpendicular, a great amount of hand picking and shoveling may be saved by blasting out the corners and sloping toes.

Where the work is very small or the areas too restricted for the use of teams in plowing, the question of hand labor is a very serious one. The pick or mattock and the shovel form the principal tools. At best, this method is a very slow and costly operation, and if any other method can be used successfully, it is generally wise to adopt it. Low-grade dynamite is the salvation of the contractor in this case, and its successful and rational use has been the turning point from loss to profit.

If possible to put it off, excavation work should not be done while the ground is frozen, for the costs are considerably increased. However, in some cases, the work must be prosecuted vigorously regardless of weather conditions, and in working "frost" the most efficient labor-saver is the low-freezing dynamite. Care should be taken not to blast too far ahead of the shovel and scrapers or the material may consolidate again.

Shipment of Paving Equipment for Use in Cuba

Part of an unusually large shipment of paving equipment is shown in the accompanying illustration. The entire shipment consisted of six cars of machinery for use in paving work in Cuba. The cars were routed by way of Key West, and carried two 3-unit asphalt plants, two 2,000-gal. and one 1,000-gal. steam-heated melting kettles, 4 tandem rollers, 2 portable boilers and engines, fire-wagons, paving tools and other equipment.

PART OF A 6-CAR SHIPMENT OF ROAD BUILDING MACHINERY FROM THE IROQUOIS IRON WORKS OF THE BARBER ASPHALT PAVING CO., TO TORRANCE & PORTAL, OF HAVANA, CUBA.

The machinery was shipped from the Iroquois Works of the Barber Asphalt Paving Co. to Torrance & Portal of Havana, Cuba, a firm which has secured extensive paving contracts in Havan and Cienfuegos.

Road Building Film Prepared by the du Pont Company

A moving picture film showing various operations in road construction with up-to-date equipment has recently been completed for E. I. du Pont de Nemours & Co., of Wilmington, Del.

The film was prepared from actual construction scenes and shows, besides the usual steps in construction, the use of explosives in grading, stump removal, and other parts of the work. The film is in two reels, each about a thousand feet long, and requires about thirty-five minutes for presentation.

Anniversary of the Asphalt Paving Industry

December 11 was the fortieth anniversary of the asphalt paving industry of the United States, the first asphalt pavement operation in the country having been completed on Dec. 11, 1876, on a section of Pennsylvania Avenue, Washington, D. C., between Sixth Street and the Treasury Building. The work was done with asphalt imported from the Island of Trinidad and in accordance with ideas developed by the Belgian chemist, de Schmedt.

Since that time about 200,000,000 sq. yd., or, roughly, about 22,000 mi., of city streets have been constructed of natural asphalt, consisting largely of material from the Island of Trinidad.

Notes

An 800% increase in export sales of Jeffery cars during the past year has been announced by J. A. Rose, Manager of Export Sales of the Nash Motors Co. Mr. Rose states that he is convinced that after the war is over, foreign markets are going to be studied more closely by automobile manufacturers, the war having shown the possibilities of foreign trade and the dependence of various countries upon one another.

The Garford Motor Truck Company through its president, E. A. Williams, Jr., announces that although there was a noticable decrease in war business in 1916 as compared with 1915, the total of Garford sales during the past year greatly exceeded that of the previous twelve months. It is stated that the volume of war orders received in 1914 and 1915 made it necessary either to go into the war order business almost exclusively or discontinue most of it in order to take care of the domestic trade. The latter course was adopted. Mr. Williams is of the opinion that notwithstanding the record breaking business of 1916, the biggest year in the motor truck industry is yet to come.

Important progress in the work of extending the use of various types of electric vehicles has resulted since March, 1916, when the Electric Vehicle Association of America became the Electric Vehicle Section of the National Electric Light Association, according to A. Jackson Marshall, Secretary of the Electric Vehicle Section. The electric vehicle is being operated successfully in several American cities for the purposes of street cleaning and refuse disposal, it is stated, and has been adopted extensively for such work by municipalities in England, France and Germany. The program which is being carried out by the National Electric Light Association it is believed will greatly increase the sales of electric vehicles during 1917. Among the special committees appointed to carry on this work is one on good roads.

Convicts to Work on the Roads of Georgia must be apportioned to the counties in proportion to the mileage of post roads included in the counties' road systems, according to a report made to the National Committee on Prisons by Judge Cann of Savannah. It is pointed out that such apportionment is practically impossible owing to the difficulty of ascertaining definitely the mileage of the post roads. It is also stated that some of the larger counties will be seriously discriminated against by such a distribution and that they are planning to prevent such operation of the law. Judge Cann is also reported as predicting that the law will be changed at the 1917 session of the legislature.

GOOD ROADS

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Number
2

Louisiana and Its Road Construction

By W. E. ATKINSON*

Situated in the lower Mississippi Valley, bordering upon the balmy Gulf of Mexico, with its climate of perennial spring, its 4,794 mi. of navigable waters, its 6,988.12 mi. of railroads, its sulphur and salt mines, its natural gas and oil fields, its virgin forests of pine, cypress, oak, gum and other timbers, its wonderful fishing grounds, its rich soils, its live stock, and, above all, its agricultural products, such as cotton, corn, cane, hay, oats, rice, potatoes, tobacco, citrus fruit, strawberries and all other kinds of vegetables and fruits —Louisiana, with all of its natural resources and wealth, and in keeping with the progress of the time, is undertaking the construction and improvement of a system of main line or market roads, connecting all of the parish (county) seats and other principal market and trade centers throughout all sections of the state.

Louisiana contains 45,966 sq. mi. of land, and 2,323 sq. mi. of landlocked bays, lagoons and rivers. Broadly speaking, this area of land may be subdivided into three divisions, viz: (1) marsh-lake lands; (2) alluvial prairies, and wooded plains; (3) hill lands. The marsh-lake lands may be assigned in general to that portion of the state bordering along the Gulf, lakes and rivers, having an elevation above tide of less than 20 ft. This division embraces about 15,800 sq. mi. of land below the 20-ft. contour, with the exception of the five islands in Iberia and St. Mary Parishes, the largest of which rises to the height of 156 ft. above the surrounding marsh land, the others being but from one-half to two-thirds as high. Since the diameter of the largest is only approximately 2 mi., their total area was disregarded in computing the area of this division.

The next, or second division, composing the alluvial prairies and wooded plains, which joins and lies north of the marsh-lake area and along the bayous and river valleys, may be assigned in general to that portion of the state extending from the 20-ft. contour to the 100-ft. contour. It embraces some 12,666 sq. mi. There is naturally no sharp line of demarcation between this topographic division and the one just described. The marsh and lake regions on the south gradually become drier to the north, and the one-time Gulf, lake and swamp bottoms assume the role of alluvial prairies and wooded plains.

The soil of the region or zone that lies nearly at the level

AN IMPROVED ROAD IN LOUISIANA—GRAVEL SURFACE.

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*State Highway Engineer of Louisiana.

A LOUISIANA SHELL ROAD.

of the 20-ft. contour is decidedly clayey and "tight-bottomed," a feature of great economic importance to the rice planter. Further up and bordering the 100-ft. contour, the soil is more sandy and is therefore more pervious to surface waters. As the 100-ft. contour is approached, the land becomes dissected by numerous small streams, and when cleared of its forest growth, presents a decidedly rolling surface. East of the Mississippi River, the plains lying near the level of the 20-ft. contour are still, in places, thickly studded with graceful, palm-like, "long-leaf" pines and magnolias, in many places the forest descending to the very edge of the swamp lands.

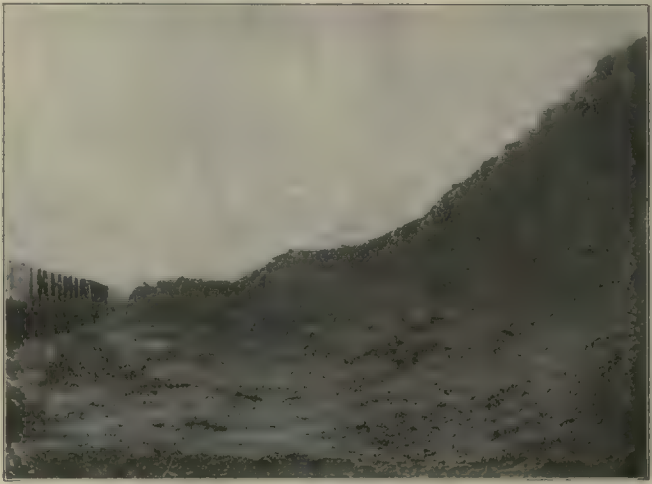
The third and last topographical division, namely, the hill lands, embraces about 17,500 sq. mi. and may be assigned to that area rising upward from the 100-ft. contour. Thus, we have the low lake and swamp lands passing gradually into the prairies and the upper undulating prairies, and the timber lands passing gradually into the more abrupt dissected area. The chief difference to be noted is that in this last division, the streams are so numerous and their valleys so deep, that there is litle left of the old sea bottom plain from which this rugged topography was carved. The soil in this area is more gravelly or sandy than in the belt below the 100-ft. contour.

Louisiana is highest in its Grand Gulf territory, i.e., its northwest central portion. Hills rise to a height of about 450 ft. and considerable tracts are above the 400-ft. contour. From here northward, the land scarcely attains the same elevation until the paeleozoic mountains of the Arkansas are reached. Moreover, the Red and Ouachita Rivers have degraded broad areas along their respective courses, reducing the general level of this higher portion of the state to perhaps less than 200 ft. elevation. In general, the state and the territory adjoining it on all sides is low, and comparatively speaking, of low relief. It might be interesting to know that, as closely as can be calculated from present data, there are in Louisiana:

UNCOMPLETED EARTH ROAD THROUGH A SWAMP.

Above the 400-ft. contour	375	sq. mi.
" " 300 " "	2,360	" "
" " 200 " "	9,240	" "
" " 100 " "	17,500	" "
" " 50 " "	27,250	" "
" " 0 " "	45,966	" "

The principal road building materials situated in the different divisions of the state, as described above, accessible for use, are as follows: In the first division, clam shells deposited in the lakes, bays and in the Gulf along its southern border; in the second division, gravel deposited both in the rivers and in strata under the surface of the ground in various places, usually gotten out in both instances with dredges; and in the third division, gravel deposited in banks in various parishes within this area.



BANK OF "NATURAL CONCRETING PAVING GRAVEL" IN LOUISIANA.

In addition to this, outcroppings of limestone and sandstone are found in the north, east and southwest central parts of the state. Aside from these, there are apparently two broad belts of gravel underlying the state. These run north and south and east and west through about the center of the state, and range from about 10 to 100 ft. and more below the surface of the ground, except in washouts or along some of the river banks where they outcrop and are exposed and accessible. Probably the most numerous of the gravel pits now operated in the state are situated in Rapides Parish, near Alexandria, although there are many others in Grant, East and West Feliciana, Tangipahoa, Webster, Ouachita and other parishes in different parts of the state.

It was during the year 1909 that the first steps were taken towards systematic road construction in this state. These preliminary efforts to furnish state aid consisted of an agreement between the state, through the Board of State Engineers, the Board of Control of the State Penitentiary, the United States Government, and the police juries (county commissioners) of the various parishes whereby state convicts were used for road improvement. As a result of the success of this venture, which demonstrated the practicability of extending state aid to the various parishes toward systematic road construction, and the advantages and benefits to be derived therefrom, the general assembly of the state, in the year 1910, passed Act 49, which created the State Highway Department. It might be of some interest to state here that, although road construction with convict labor was found to be economical and advantageous, no forces of this character are at present employed in this capacity, for the reason that all prisoners are needed on the state farms. However, that such labor may again be available for road construction in Louisiana is not improbable.

Act 49 of 1910, together with an amendment to the constitution of the state—Article 291, Constitution of 1913—vests the Highway Department with authority and power to give state aid, both monetary and supervisory, to the various parishes towards the construction and improvement of state highways throughout Louisiana, under certain conditions, and provides a revenue for aiding in carrying out the work so undertaken. This revenue, which amounts to approximately $140,000 annually, is derived from a state tax of ¼ mill on the dollar of assessed valuation, for the purpose of creating a highway fund with which to aid the parishes in constructing and maintaining state highways.

Of the four methods whereby state aid may be extended to the various parishes, according to law, viz.: monetary aid by contract; convict labor state aid; road outfit state aid and force account state aid, the first and last mentioned were the only forms employed during the past two or three years.

LOADING PIT RUN GRAVEL INTO CARS WITH A MARION STEAM SHOVEL.

Practically all construction work is undertaken by contract, while all maintenance and repair work is performed both by force account and by contract, depending upon local conditions. There is one principle, however, that is strictly adhered to, no matter what form of state aid is extended, and that is, that all work undertaken must be performed under the direct supervision of the State Highway Department.

In order that each parish may have the same opportunity to participate in each year's highway fund, and that all necessary surveys and investigations may be made whereby such details as pertain to location, direction, character of construction, drainage, quantities and approximate cost, etc., may be properly determined in ample time for all interests, the department has found it necessary to adopt a policy systematizing the methods governing the parishes in making application for state aid. Once a year, the department issues a circular letter which is sent to the police jury of each parish in the state, advising that on a certain date, the state highway fund collected during the year will be prorated among the parishes making proper application and qualifying for state aid on or before a fixed date—usually the first of the year. This gives each parish the same opportunity to apply and qualify and to participate in each year's fund if it so desires. Any part of the highway fund not apportioned during the year is either carried forward into next year's fund or reapportioned among the parishes qualifying for aid. The number of parishes that qualify for state aid and the magnitude of each project proposed regulate the amount allotted to each parish, and as a result, the proportions paid by the state and the parish on different projects undertaken, has varied from one-half and one-half to one-tenth and nine-tenths, respectively, of the total cost. In addition to the monetary aid furnished by the state, as outlined above, the state also furnishes trained supervision for each project, the salary of the resident engineers and inspectors being paid by the state.

CONCRETE BRIDGE ON A LOUISIANA ROAD.

Soon after the Highway Department was organized and placed upon an active basis, it was realized that, from an economical and practical standpoint, the construction of state highways with public money should be undertaken in a systematic manner and with some concrete object in view. Accordingly, it was proposed that the highway fund collected each year be devoted to the construction and maintenance of a system of main line or market highways, laid out upon definite lines, with the object in view of ultimately connecting all links that would be completed from time to time, thereby completing this system, which embodies some 4,500 to 5,000 mi. of highways. This general plan, as approved, adopted and officially put into operation, provides for the construction of a system of highways built according to modern practice,

GRAVEL SCREENING AND WASHING PLANT.

connecting each parish seat with the parish seats and principal trade centers of the adjoining parishes. This plan has been favorably received by the parishes throughout the state, and they, in most instances, are extending their efforts and cooperation to the Highway Department towards its final achievement. This comprehensive plan or system of highways has also received the sanction of the Office of Public Roads and Rural Engineering of the U. S. Department of Agriculture in the matter of extending federal aid to the state for good roads construction.

In conjunction with the building of this system of main line market highways, the Highway Department realizes and recognizes the fact that maintenance is equal in importance to construction. This detail is given due consideration in the body of the law creating the department, under conditions similar to construction work, and the department recommends and urges that all roads be kept in good condition and repair at all times and lends its assistance to having this done. All of the parishes are giving this important feature of road work due consideration.

According to the best available data, Louisiana has about 25,000 mi. of public roads, of which approximately 5,000 mi. have been selected and embodied in the system of state market highways. Starting out in 1911 with 5,000 mi. of practically unimproved earth roads to construct on a limited annual fund, which could not be expended until aid was sought from the state by the various parishes, the results so far accomplished by the Highway Department are very gratifying. Including the roads constructed with state convicts, there have been undertaken and completed by the Highway Department, to November 1, 1916, 647 mi. of highway, of which 444.71 mi. are top-soil and sand-clay, 36.00 are shell, and 166.29 are gravel. In addition to this mileage already completed, there is under construction at the present time, 168.79 mi. of road, of which 22.30 are top-soil and sand-clay, 10.00 mi. are shell, and the remainder, 136.49 mi. are gravel. However, included in the 136.49 mi. of gravel roads now under construction are 78.10 mi. previously improved by the Highway Department and classified as top-soil and sand-clay roads which are included in the 444.71 mi. of this type of road shown above. Deducting this duplication of mileage, there have been constructed and are now under construction, 737.69 mi., net, of highway, of which, when completed, 348.78 mi. will be hard surfaced and 388.91 mi. top-soil and sand-clay. It is estimated that these roads will cost approximately $3,000,000, or about $4,000 per mi. for all types of construction.

The department now (Dec. 1, 1916) has on file applications for about 450 mi. of new work to be undertaken during the year 1917. Inasmuch as the popularity of the gravel road has been rapidly spreading throughout the state, 85 to 90 per cent. of the applications on file are for this type of construction. Due to the limited fund to be apportioned among the parishes on January 1, 1917, it is hardly possible that the improvement of this entire mileage can be undertaken during the coming year. However, it is safe to assume that at least two-thirds or three-fourths of this new work will be undertaken in 1917. This, when completed, will bring the mileage of state market highways constructed up to approximately 1,000 mi., a very creditable showing, all things considered.

While the mileage of road actually improved by the Highway Department since its creation in 1911 and the prospects for work to be undertaken in the near future are very encouraging, probably the most important work, aside from this, undertaken by the Highway Department, is of an educational nature. It has been the constant endeavor of the Highway Department during its entire existence to foster and encourage the good roads movement in the state, to demonstrate the advantages and practicability of systematic road construction and maintenance, to show by actual results the benefits to be derived from road improvement.

That its efforts in this direction have not been unsuccessful and that the citizens of our state are demanding an early completion of the system of state highways are best evidenced by the fact that at the last session of the legislature, a bond issue of $20,000,000 for roads was introduced and was defeated only by reason of the fact that the subject was too important and vital to the state's interest to be put into effect without mature consideration. This was not possible under the circumstances, the bill having been introduced during the latter part of the session. That such a bond issue will be voted or more funds provided through an increase in the good roads tax is very probable, as is evidenced by the serious consideration being given this important subject at the present time.

When this is done, together with the $1,019,250 to be received from the national government through the agency of the federal aid road act passed by the last session of Congress, an early completion of Louisiana's comprehensive system of state highways may be expected. When this system is completed, Louisiana will have a network of market highways traversing the state in all directions, providing ample facilities for all interests—a good roads system of which the state as a whole may justly be proud.

New Philadelphia Permit Notice for the Occupation of Highways

A new form of notice of permission to occupy portions of the public streets with building materials has recently been adopted by the Bureau of Highways, Department of Public Works, Philadelphia, Pa. The notice is printed on a yellow card 8½ x 11¼ in. in size and is required to be displayed conspicuously on the occupied portion of the street. The upper half of the card carries the following notice:

PERMIT NOTICE.

FOR OCCUPATION OF HIGHWAY WITH BUILDING MATERIALS

This Notice is to Certify that on this date,............191..,
the Bureau of Highways has issued this Permit Number......
to (Name).................. (Address)..................
to occupy with BUILDING MATERIALS until............
191.., inclusive, subject to the following regulations, a portion of the roadway of.............Street at.............., along one frontage of the permittee's abutting property, and, if necessary, an additional continuous frontage of not exceeding 80 feet in one direction.

For the information of the representatives of the Bureau of Highways, the Bureau of Police, and the public, this permit notice card must be displayed in a conspicuous location on the occupied highway at all times during the period of such occupancy.

The continuity of the validity of this permit is dependent upon the strict observance of all the regulations indicated herein, and failure at any time to comply therewith will result in the immediate suspension of the permit, and will also subject the permittee to the indicated penalties.

Below this are printed the regulations governing the storage of building materials, the construction of footway shelter platforms, the use of danger lamps, the placing of mortar beds and material heaters, and the conditions of occupied highway.

Chief Connell of the Bureau states that during the past there has been considerable difficulty experienced in controlling the exercise of the privileges granted by permits of this kind. It is believed that by the use of the new form it will be possible to control the matter in a much better way, as it will make it possible for every interested citizen to be a "cooperating inspector," and will also make it possible for any citizen to ascertain whether or not the permittee is complying with the regulations to which he is supposed to conform.

The Present Status of Road Building in Michigan

By D. A. THOMAS*

When road construction was abandoned at the close of the season of 1916, Michigan had approximately 5,000 mi. of improved highways or one-third of the mileage necessary to adequately serve the entire state. On June 30, at the close of the 1916 fiscal year, there were 4,289.25 mi. of road in the state that had been constructed according to the specifications of the State Highway Department and accepted for state reward. At that time, however, the work projected for the 1916 season was only fairly started, and before winter nearly 700 mi. had been added to the total.

Michigan possesses over 70,000 mi. of public roads, and at first glance it would seem that a stupendous amount of road building would devolve upon the people of the state by virtue of this large mileage. It is apparent, however, that a few thousand miles of well built, properly located highways will enable one to go from town to town all over the state without leaving a surfaced road, nor will any farmer have to drive more than a mile or two to reach such a road. There are about 10,000 mi. of railways in the state, counting both steam and electric lines. Yet they reach practically every city, village and hamlet—often entering from as many directions as do the roads. With 15,000 mi. of highways built, the state should be well provided for. The roads already built are for the most part on lines radiating out from cities and towns, but have not been extended far enough to be connected at the ends. To fill the gaps which exist will be the effort in the future.

Nearly 900 mi. of road constructed since 1913 form a part of the state trunk line system which comprises a network of over 4,500 mi. of road in both the upper and lower peninsulas and is designed to serve the state as a unit. The construction of trunk line roads is encouraged by the payment of double the usual reward on roads built according to the state specifications, and by the construction by the state of bridges over 30 ft. in span on trunk line routes. The State Highway Department is required to make all surveys and plans for trunk line roads. The trunk line law, which was passed by the legislature of 1913, greatly increased the powers and expenditures of the department and made necessary large increases in the field and office force which now numbers about 70 employees, most of whom are graduate engineers.

In addition to the supervision of all state reward road work, a very important activity of the State Highway Department has been the construction of substantial bridges on trunk line roads according to the provisions of the law. Over $250,000 has been expended in this work during the past three years. To date, 80 bridges have been erected or are in the process of construction, ranging in cost from $2,000 to $25,000.

Including the appropriation for 1917, and $767,602.22 received from the automobile tax, $5,192,602.22 has been credited to the state highway funds during the past eleven years. Of this $3,916,145.36, or practically $4,000,000, has been returned to the counties in the form of state rewards. Trunk line bridge construction cost the state $277,725.50, while the cost of making surveys and the preparation of plans for trunk line roads totaled $78,954.59. The appropriations for departmental expenses amounted to $173,000.00 during the 11-year period. An unspent balance of $746,776.77 remained to the credit of the department on Oct. 1.

It is the endeavor of the Michigan State Highway Department, by virtue of the power vested in it by the legislature and with the cooperation of the counties and townships, to provide for Michigan through highways and farm-to-market roads where they are needed, all of which will satisfactorily carry the traffic imposed upon them for the least cost. A comprehensive system of highways which will serve the whole state is fast becoming a reality.

CUT ON A ROAD IN SOUTH HAVEN, MICH.—SHOWING WELL-FINISHED SLOPES AND DITCHES.

SURFACE-TREATED MICHIGAN ROAD. WEST MICHIGAN PIKE NEAR PETOSKEY.

The Importance of Roads is well expressed in a quotation from an unknown author which is used as the preface of a recent bulletin of the A. and M. College of Texas. The quotation follows. "Roads rule the world—not kings nor congresses, not courts nor constables, not ships nor soldiers. The road is the only royal line in a democracy, the only legislature that never changes, the only court that never sleeps, the only army that never quits, the first aid to the redemption of any nation, the exodus from stagnation in any society, the call from savagery in any tribe, the high priest of prosperity, after the order of Melchisedec, without beginnings of days or end of life. The road is umpire in every war, and when the new map is made, it simply pushes on its great campaign of help, hope, brotherhood, efficiency and peace."

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*Michigan State Highway Department.

The Value of a Training in the Humanities for Engineers[*]

By **NELSON P. LEWIS**[†]

While there are some conspicuous instances of engineers who have achieved marked success without the advantage of a degree from a technical school, the large majority of practicing engineers have had the benefit of a technical course before beginning their professional careers. In order to make any intelligent suggestions as to the subjects which should be included in such a course of study, it would be well to consider briefly the kind of work the engineer will be called upon to do. Engineering was formerly believed by the average citizen to be little more than a trade. It was thought that an engineer should be able to use surveying instruments and be able to compute land areas and the volume of a cut or fill or of a mass of masonry. He might be able to build a road, but in this respect he was held to differ very little from the average citizen, who appears to have been born with the conviction that he is as competent to build a road as to serve in Congress. The engineer's function was conceived to be the planning and carrying out of what others may have concluded to be necessary and expedient. Those who determined what was to be done seem to have felt it to be the duty of the engineer to do things when he was told, as he was told and because he was told. For a long time the engineer himself appeared to acquiesce in this conception of his functions. Whether or not a certain project was feasible or timely, whether the type of structure or the material which it was proposed to use was best adapted to the purpose, whether the enterprise would justify itself on economic grounds, whether the plan of financing it was sane and prudent, whether the terms of the franchise or concession, if such were involved, would insure adequate protection for the public and at the same time permit a fair return on the capital investment—such questions were not his concern. They would be settled by attorneys, capitalists or the public authorities. The engineer himself was not inclined to assume any responsibility for them; it was his duty to see that the general plans were honestly and expeditiously carried out. While he realized his responsibility for the stability of any structure erected under his direction he had little concern for anything but its physical stability, although he desired assurance that the funds were available to cover his fees or salary.

These were the conditions which prevailed within the memory of most of us, but they do not exist at the present time, except possibly in some branches of the public service, municipal, county, state and even federal. No financial concern engaged in floating bonds for private enterprises will now undertake to handle such securities until they have had a report from competent engineers as to the soundness of the project, including not only its engineering feasibility but its probable earning capacity and the market for its output, whether that be power, light or any manufactured product. Such reports, if they are to carry conviction, must not only be technically sound, but they must be orderly in arrangement, clear and concise in the presentation of facts, arguments and conclusions, and must bear upon their face evidence of the absolute confidence of the writer in the accuracy of his facts and deductions. Further than this, the engineer must frequently present verbal explanations and arguments to the promoters or to a board of directors before the enterprise is undertaken as well as during its progress, if he is charged with its execution. Many reports resulting from thorough and painstaking investigation fail of their purpose because the subject matter is not presented in an orderly manner and the conclusions are not clearly and concisely expressed. Often, too, when the engineer is called before a board of directors and asked for further information the impression which he makes is an unfavorable one, due, chiefly, to the use of poor English and the self-consciousness which comes from lack of practice in speaking.

The head of a large industrial corporation, who was also the chairman of a board of trustees of an engineering school and was urging the broadening of engineering education, put the case in this way:

> We can get plenty of men who are technically competent, who are careful and thorough in their investigations, whose conclusions we know to be sound, but who cannot make a favorable impression before a board of directors. We can get plenty of lawyers, who, after being coached by our engineers, can glibly and even convincingly talk to this same board of directors until some question is asked which has not been covered in the process of coaching, when they, too, will flounder about. If we can secure a man who possesses the conscientious thoroughness and accuracy of the engineer and also has the facility of expression and persuasiveness of the lawyer, what is a salary of $25,000 or $30,000 to us for such a man?

He, therefore, urged that this particular school, instead of trying to turn out a large number of $2,000 to $5,000 men, give to the profession a limited number of $25,000 to $30,000 men.

What kind of studies are best calculated to fit a man for such a professional career. Let us say that the purpose of his training should be to insure:

(a) Honesty and accuracy in his reasoning.

(b) The habit of thoroughly testing his conclusions in order that they may be not only the logical, but the inevitable, result of his premises.

(c) Clearness and simplicity in his presentation of both premises and conclusion.

(d) Orderly and logical arrangement of both, so that they may readily be followed by those to whom they are addressed.

Personal honesty and high professional ideals are, of course, essential to true success in any occupation, but the course of training in these subjects should begin before a boy is born and we are considering only his professional training after the high school period.

The study of mathematics should induce accuracy in thought and work. An error cannot be tolerated and will inevitably be discovered in the solution of a mathematical problem which, if properly checked, will prove itself. If not so checked and its accuracy proven, the perpetrator of a mistake cannot escape its consequences. Such reasoning, however, is conducted through the medium of formulae and equations which are not understood by the layman for whose benefit they must be converted into ordinary language. If we are to insist, as it will doubtless be admitted that we should, that engineering is one of the learned professions, ranking in dignity with law, medicine and theology, we may also insist upon the desirability of an equally thorough foundation upon which engineering training is to be based. It will be futile to urge that engineering degrees should be given only as the result of a post-graduate course open exclusively to those presenting arts degrees. While the increasing number of men holding such degrees who come to our best engineering schools is most encouraging, it will be unwise to insist upon this as an entrance requirement. To do so would exclude many earnest young men who possess the natural ability, ambition and industry to achieve success in whatever they undertake, but who have neither the means nor the time for both the arts and engineering courses. What we may properly insist upon is that the courses in our engineering schools be liberalized by the introduction of some culture studies. Dr. J. A. L. Waddell, who has been insistent in urging the broadening of engineering education, said in an address to the Engineers' Society of Western Pennsylvania:

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[*] Paper presented before Section D, Engineering, of the American Association for the Advancement of Science, New York, N. Y., Dec. 28, 1916.

[†] Chief Engineer, Board of Estimate and Apportionment, New York, N. Y.

> Technical teachers are beginning to awaken to an appreciation of the fact that it has become absolutely essential to instruct their students in other lines than mathematics and technics in order properly to fit them for their life's work and that American engineering courses will have to be broadened so as to provide thorough instruction in economics, history, oratory, logic, business and other studies of a non-technical nature. Without a good grounding in such lines the engineer of the future will continue to be a narrow technist—unappreciated by the community and insufficently compensated for his labors.

I am not taking too literally the subject assigned to me and insisting upon a study of "the Humanities." The term is an old one and its meaning is not quite clear. The Century Dictionary defines the humanities as "including learning or literature of a merely human or secular kind as opposed to divinity, and generally the several branches of such literatures as philology, grammar, rhetoric, poetry, the study of the ancient classics and the like." Professor G. P. Marsh notes that the conviction of the value of these studies as a moral and intellectual discipline has led scholars almost universally to ascribe the origin of this appellation to a sense of their refining, elevating and humanizing influence. He expresses the belief, however, that it is an erroneous etymology, holding that they were so called in distinction from divinity, the two studies of philology and theology then completing the circle of scholastic knowledge which at the period of the introduction of the phrase scarcely included any branch of physical science. May I not then take sufficient liberty with my subject to insist that engineering courses must be enriched by the introduction of culture studies?

It is quite probable that familiarity with the classics, supplemented by a thorough course in one's own language, will greatly enrich one's vocabulary, but all of this is not needed to enable an engineer to write an intelligent report or to address a board of directors. It is not necessary that a report dealing with an engineering subject should be expressed in the language of a Howells or a James, nor will its force and that of its conclusions be lessened by the occasional use of a split infinitive or through the employment of a phrase that might give pain to some purists. It will, however, be much more forceful if expressed in simple but virile language, the habitual use of which can be acquired only by the reading of the best literature.

Many of the so-called colleges of liberal arts no longer insist upon Greek and require little Latin on the part of candidates for admission, while Latin is not carried beyond the freshman year except as an elective, although the enforcement of the group system, with one major subject and carefully balanced electives, is calculated to produce a well-educated man, if not a scholar in the old sense. Why should not our engineering schools so modify their curricula as to insist upon a major group of engineering subjects, supplemented by a thorough course in the English language and literature, a good training in, not a smattering of, one other modern language, and courses in history, economics and the law of contracts? But the technical school men will say, we would not have time to do this unless we shorten or omit some of the courses which we believe to be essential to an engineering education or add another year to our course. Then let them adopt one or the other of these alternatives, and it is quite probable that the records of their graduates would reflect greater credit upon these schools than they have in the past. A number of specific instances could be given of men whose professional training has been along entirely different lines and who have attained conspicuous success as engineers. While these cases may be exceptional, they are sufficiently numerous to justify a reference to them and even to support the plea for liberalizing engineering training.

The six-year course leading to both the arts and engineering degrees which has been adopted by a number of our universities is most encouraging evidence that engineering is coming to be considered one of the learned professions, and yet for those who can afford the time and money the ideal plan would be to pursue their culture studies in one of the smaller colleges which have not yet gone to an extreme in the adoption of the elective system. A young man will be more likely to attain real culture in such an institution, his interests will be broadened, his life friendships will be among men of various professions and occupations and he will have a better opportunity to find himself and make a wise choice of a profession if that choice may be deferred until the latter half of his college course. The influences and associations of the college campus are distinctly humanizing and, even though he may attach as much importance to athletics as to scholarship, he will have laid an admirable foundation upon which the superstructure of his professional education may be reared. The writer realizes that, while this plan may be ideal, it is beyond the reach of a great majority of those who wish to enter the engineering profession.

Next to this in its advantages may be placed the six years' course leading to the arts and engineering degrees, but even this is too long in most cases and the greatest number of engineering students will continue to begin their professional courses immediately after finishing their secondary school work.

It is unfair to these young men, it is unfair to the engineering profession, to confine their further education wholly to strictly technical courses. Extend these courses to five years, if necessary, in order to introduce the liberal studies which have been referred to, giving credit to those who present degrees from reputable colleges, so that they may complete the strictly technical work of the curriculum in four or even three years. In other words, it is time that those who are responsible for the training of engineers realized that they are fitting men for one of the learned professions and that this cannot properly be done unless the curriculum is humanized.

Road Week at Madison, Wisconsin

The Wisconsin Highway Commission will hold its sixth annual road school at the state capitol at Madison, Jan. 29 to Feb. 3, inclusive.

Invitations are extended to all who are interested in road and street construction. Last year's registration at the road school numbered more than 700, and a large attendance is expected this year.

The plan of instruction will include the discussion by experts from Wisconsin and elsewhere of recent developments in highway construction, maintenance and administration.

Short Course in Highway Engineering at the University of Michigan

The third annual short course in highway engineering at the University of Michigan will be given at Ann Arbor, Feb. 19-23. This is an extension of former courses, and while it is intended primarily for the benefit of the highway commissioners, highway engineers and contractors of the state it is open without charge to anyone interested in highway problems.

The financing, construction and maintenance of roads, with special reference to road conditions in Michigan, are the subjects to be treated. The instruction will be given under the supervision of the engineering faculty of the university and the Michigan State Highway Department, and will be supplemented by lectures by prominent highway officials from other states.

Work on the Lincoln Highway in 1916

In the 1916 report of the Lincoln Highway Association, note of which is made elsewhere in this issue, the work of the association during 1916 is reviewed in considerable detail. There are included also data on the work accomplished to date.

The sum of $4,198,165 is shown by the available records to have been expended during 1916 on the roads included in the route of the Lincoln Highway, according to the report. The total for the year is estimated at $6,000,000, while the total for the three years is put at $10,000,000.

Another accomplishment of the past season was the completion of the official "log" of the route. This work was done by the field secretary and included the securing of a record of each piece of construction, showing its location, character, cost and condition.

Considerable progress is reported in placing standard markers along the route. Work was commenced at the eastern end of the road and carried through Nebraska, a crew of four men with two automobiles being employed by the organization.

The condition of the route in various states is given in detail in the report. According to the statements made, the greater part of the route has been improved in New Jersey, Pennsylvania, Ohio and Indiana, marked progress has been made in Illinois and Iowa, and continued efforts are being made in the western states, California ranking with the eastern states in the amount of work done to date.

A financial statement for the thirteen months ending Sept. 30, 1916, accompanies the report. This shows receipts as follows:

Founders' pledges paid	$17,500.00
Contributions	2,822.00
Other sources	12,869.01

Included in the item "other sources" are funds received from the sale of certificates, guide books, guide book advertising, maps, buttons, pennants, etc. The balance in bank on Sept. 1, 1915, was $2,684.09.

Disbursements amounted to $31,672.37, the principal items being as follows::

Salaries	$12,954.36
Traveling expenses	2,637.34
Advanced to "feature film"	2,552.66
Publicity	2,169.72
Postage	1,576.00
Paid on 1916 guide books	1,399.13
Printing	1,347.10
Office and shipping headquarters rent	1,144.00
Cement	1,094.70

Chief among the assets listed in the report are the sum of $9,708.31 representing deposits with banks and $41,400 representing founders' pledges available for future general purposes. The first amount consists of sums deposited in various states along the route of the highway by individuals interested in the work. The deposits are in the name of the association and unless there is some other understanding are used for construction purposes in the immediate vicinity of the banks where they are deposited. The $41,400 available from balances of founders' pledges represents $4,400 due Sept. 30, 1916, $18,500 due in 1917, and $18,500 due in 1918. The founders of the association are as follows: James A. Allison, Indianapolis, Ind.; Bijur Motor Lighting Co., Hoboken, N. J.; S. F. Bowser & Co., Fort Wayne, Ind.; Emory W. Clark, Detroit, Mich.; Continental Motor Co., Detroit, Mich.; Dayton Engineering Laboratories Co., Dayton, Ohio; Firestone Tire & Rubber Co., Akron, Ohio; Carl G. Fisher, Indianapolis, Ind.; General Motors Co., Detroit, Mich.; Christian Girl, Cleveland, Ohio; Goodyear Tire & Rubber Co., Akron, Ohio; Wm. Randolph Hearst, New York, N. Y.; G. W. Houk, Buffalo, N. Y.; Hudson Motor Car Co., Detroit, Mich.; Henry B. Joy, Detroit, Mich.; Lehigh Portland Cement Co., Chicago, Ill.; A. C. Newby, Indianapolis, Ind.; Packard Motor Car Co., Detroit, Mich.; Paige-Detroit Motor Car Co., Detroit, Mich.; Prest-O-Lite Co., Indianapolis, Ind.; F. A. Seiberling, Akron, Ohio; Universal Portland Cement Co., Chicago, Ill.; Willys-Overland Co., Toledo, Ohio.

The financial statement also includes a list of cement contributions. The contributors with the amounts contributed are as follows: Atlas Portland Cement Co., New York, N. Y., 6,000 bbl.; Marquette Cement Mfg. Co., Chicago, Ill., 5,000; Chicago Portland Cement Co., Chicago, Ill., 5,000; Crescent Portland Cement Co., Wampum, Pa., 2,000; Sandusky Portland Cement Co., Sandusky, Ohio, 5,000; St. Louis Portland Cement Works, St. Louis, Mo., 5,000; Northwestern States Portland Cement Co., Mason City, Ia., 5,000; Universal Portland Cement Co., Chicago, Ill., 3,000. The contribution by the Atlas Portland Cement Co., according to the statement, was later withdrawn leaving a total of 30,000 bbl. contributed.

State Aid Work in Christian County, Illinois

The Board of Supervisors of Christian County, Illinois, have selected five routes in the county upon which the state aid appropriation of $25,824 will be expended in equal amounts. The sections of highway to be improved, each about 2 mi. long, are as follows:

Extension of 1916 route east of Taylorville, known as Section A; extension of 1916 route south of Taylorville, known as Section B; extension of 1916 route west of Pana, known as Section C; new route extending from the north end of four-mile lane out of Taylorville; and the road running northwest out of Taylorville across the Vandeveer Bridge, a distance of about 2 mi.

Short Course in Highway Engineering at the University of Illinois

A short course in highway engineering given under the direction of the Civil Engineering Department of the College of Engineering of the University of Illinois, note of which was made in "Good Roads" for Nov. 11, 1916, commenced on Monday of this week and will end on Friday, Jan. 19.

Morning, afternoon and evening sessions are provided for all week days except Friday and Saturday when the evening sessions are omitted. The morning sessions, as a rule, are devoted to discussions of special phases of road and bridge construction and surveying. The work on roads is in charge of C. C. Wiley, Instructor in Highway Engineering, that on bridges is in charge of N. B. Garver, Instructor in Highway Bridge Engineering, and that of surveying in charge of G. W. Pickels, Instructor in Surveying. The afternoon and evening sessions are devoted chiefly to addresses and lectures on road and bridge work, with open discussions.

Among the lecturers are C. A. Ellis, Professor of Structural Engineering at the University of Illinois; A. R. Losh, Engineer Economist, Office of Public Roads and Rural Engineering, U. S. Department of Agriculture; Pres. A. D. Gash, Secretary S. E. Bradt and James P. Wilson, of the Illinois State Highway Commission; W. W. Marr, Chief State Highway Engineer of Illinois; Clifford Older, Bridge Engineer; H. E. Bilger, Road Engineer, and B. H. Piepmeier, Maintenance Engineer, of the Illinois State Highway Department; A. R. Hirst, State Highway Engineer of Wisconsin; Division Engineers J. E. Huber, A. H. Hunter and H. B. Bushnell of the Illinois State Highway Department; P. C. McArdle, Superintending Engineer, Vermillion County Bond Issue Roads; H. C. Adams, President, Danville Brick Co.; A. N. Johnson, Consulting Engineer, Portland Cement Association; a number of county superintendents of highways of Illinois, and others.

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Old Series, Vol. LI. Number
New Series, Vol. XIII. 2

Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

JANUARY 13, 1917

"BITUMINOUS MACADAM" AND "BITUMINOUS CONCRETE"

The terms "bituminous macadam" and "bituminous concrete" are now generally recognized as the proper designations for the two general classes of roads composed of relatively coarse mineral aggregate bound with bituminous material. By the usage of those most conversant with road building terminology the former is applied to bituminous roads built by the penetration method and the latter to bituminous roads built by the mixing method.

So far as is shown by the available records, the first definite recommendation from an engineering organization that these meanings be adopted was made seven years ago by the committee on asphaltic and bituminous pavements of the Organization of City Officials for Standardizing Paving Specifications, an association that was later merged with the American Society of Municipal Improvements. At that time mention of the matter was made in these columns and we have since referred to it several times, always urging that the terms be used in accordance with what now very nearly has become standard usage. During the past few years various organizations that have taken up the nomenclature of road work have adopted definitions of "bituminous macadam" and "bituminous concrete" agreeing with the definitions of 1912, previously mentioned, chief among them being the American Society of Civil Engineers which took such action through its special committee on road materials.

Attention has recently been directed to the matter by a footnote in Bulletin No. 407 of the U. S. Department of Agriculture, "Progress Reports of Experiments in Dust Prevention and Road Preservation, 1915." In the opening paragraph of that publication the experimental work is described as consisting of the construction of roads surfaced with a variety of bituminous pavements, including "bituminous macadam by the penetration and mixing methods." The footnote mentioned refers to this, and is to the effect that in future publications of the Office of Public Roads and Rural Engineering "bituminous macadam by the penetration method" will be called simply "bituminous macadam" and "bituminous concrete by the mixing method" will be called "bituminous concrete."

It is gratifying to note that the Office of Public Roads has finally seen fit to conform to the usage we have so long advocated and that has been so generally followed elsewhere. There would seem to be no good reason for using any different nomenclature at present and it is to be hoped that the example of the Office of Public Roads will be followed by writers who still cling to the older and more clumsy forms.

At least there should be no further use of the term "bituminous macadam by the mixing method" for it is incorrect as well as unwieldy. According to the present understanding of the terms in question, a bituminous road built by the mixing method is not a macadam road at all, but a concrete road. It should, therefore, be designated as such, with the term "bituminous" to distinguish it from a cement concrete road. If, for any reason, it seems desirable to use a phrase whose meaning can not be mistaken, "bituminous concrete by the mixing method" should be employed, for the worst that can be said of it is that it is redundant.

THE ENGINEER AND THE "HUMANITIES"

From a strictly materialistic and utilitarian standpoint the engineer stands next to the farmer as a member of society whose services are well-nigh indispensable. In whatever of the many branches of engineering he is engaged, he provides the structures and the machinery which make possible the industrial and commercial activities of the present time.

Too often he does nothing more. He looks upon his work as merely the utilization of physical forces and materials to purely physical and material ends and sees no further than the completed structure or machine upon which he is engaged. There are some who have overcome or escaped this tendency. To these, roads are not merely hard, smooth tracks over which wagons and motor trucks can carry the maximum loads with the minimum expenditure of energy, but pathways of progress over which mankind may go on to better things—intellectual and spiritual as well as material. The achievements of the science and art of engineering are seen by them not as ends in themselves but as means to greater ends. These men are truly representative of the engineering profession but, unfortunately, are not the men by whom the profession as a whole is judged by the world.

In the rank and file of engineers are many men who deserve the reputation for narrowness which has been given to engineers as a class. They are partly but not wholly to blame for this and for their failure to occupy the place which they should in the esteem of the public. The unsatisfactory status of engineers is being realized more and more by the engineers themselves and they are frankly discussing the reasons for the failure of the profession to obtain the standing it deserves and are making efforts to bring about better conditions through engineering societies and through changes in the methods of educating engineers. The latter can be expected to bring about the better results, for it is probable that the chief cause of present conditions is the training which the engineer receives in the technical schools.

The average engineer who has had the benefit of technical training has graduated from a four-year course in an engineering school after completing a high school course of the usual type and perhaps a short supplementary course in a preparatory school. Almost every study he has taken up in his engineering course has been based upon mathematics or natural science, and he has acquired a certain intellectual bias which causes him to attach undue importance to these branches of knowledge and to ascribe too little value to others. He has become essentially a "practical man," totally lacking, or with only a partly developed, imagination. He lacks the broad outlook which the physician or the lawyer possesses, and while able to utilize things is almost helpless when it comes to dealing with men.

The whole subject of the training of engineers was discussed at considerable length at a recent meeting held under the auspices of the American Association for the Advancement of Science and other organizations. Among the papers presented was one by Nelson P. Lewis, Chief Engineer of the Board of Estimate and Apportionment of New York City, in which the value of culture studies—or the "humanities"—in engineering courses was discussed at some length. The paper is printed in full on other pages of this issue and is commended to the attention of those who are interested in this subject. Particular attention was called by Mr. Lewis to the narrowing effect of courses confined to technical subjects, and references was made to men who had attained eminence as engineers after receiving professional training along entirely different lines.

Although the men referred to were undoubtedly of exceptional ability their example indicates that the importance of specialized study is often exaggerated, and that, even from a "practical" point of view, a broader education would be of advantage to engineers.

Peoria County, Illinois, to Submit Bond Proposal to Voters

The County Board of Supervisors of Peoria County, Ill., met recently and decided by a vote of 42 to 5 to place the question of a bond issue for the construction of roads before the people on April 3.

The issue proposed is for $1,700,000 with interest at 4½ per cent. At a previous meeting the board had offered a resolution to call a special election for Jan. 16, but as the Illinois law provides that tax levies must be made at biennial elections, the election was scheduled for the later date, which corresponds with the township elections.

Road School at Purdue University

The third annual road school under the auspices of the School of Civil Engineering of Purdue University will be held at LaFayette, Ind., Jan. 16-18.

The school will comprise a series of lectures, laboratory demonstrations and conferences on highway construction and maintenance, bridges and culverts, and the testing of road materials. Special attention will be paid to conditions in Indiana. An outline of the program follows:

Tuesday afternoon, Jan. 16. Addresses of welcome by President Stone of Purdue University and Dr. W. K. Hatt of the School of Civil Engineering; Reply by J. J. Hendricks, President of the Superintendents' Association; "Construction of Concrete Roads," L. E. Tex, County Road Superintendent, Marion Co., and Q. E. Bundy, County Road Superintendent, Montgomery Co.; "Maintenance of Concrete Roads," W. G. Tonkel, County Road Superintendent, Allen Co.; "Causes of Success and Failure in Road Work," George E. Sprinkle, County Road Superintendent, Huntington Co.

Tuesday evening, "Road Improvement," illustrated lecture by Dr. L. I. Hewes, Office of Public Roads and Rural Engineering, U. S. Department of Agriculture.

Wednesday forenoon, "Gravel Road Construction" (illustrated), Prof. G. E. Martin, Purdue University; "Gravel Road Maintenance," C. N. Warren, County Road Superintendent, Hancock Co.; "Bituminous Covering for Gravel Roads," F. D. White, County Road Superintendent, St. Joseph Co.; "Road Drainage" (illustrated), Dr. Hewes.

Wednesday afternoon, "Bituminous Materials for Road Construction," Prof. H. C. Peffer, School of Chemical Engineering, Purdue University; "Testing Road Materials," Prof. Scofield, Laboratory for Testing Materials, Purdue University.

Wednesday evening, annual meeting of the County Highway Superintendents' Association at the Fowler Hotel.

Thursday forenoon, "Road Maintenance Cost," A. E. Lisby, County Road Superintendent, Putnam Co.; "Maintenance of Macadam Roads," Prof. Martin; "Bridge Repairs," O. A. King, County Road Superintendent, Miami Co.; "Cooperation with U. S. Office of Public Roads in Monroe Co.," J. S. Brown, County Road Superintendent, Monroe Co.; "The Patrol System," W. O. Jones, County Road Superintendent, Wayne Co.

The meeting of the Indiana Engineering Society will be held at Purdue University at the close of the road school. The sessions will begin at 2 p. m. Thursday, Jan. 18.

Cement Contracts Awarded in Illinois

The Illinois State Highway Commission has recently awarded contracts for over 2,000,000 bbl. of Portland cement at prices ranging over and below $2 a bbl. The contracts were let as follows:

Chicago Portland Cement Co., Chicago, Ill., 35 counties, 39,500 bbl.; Universal Portland Cement Co., Chicago, 12 counties, 64,100 bbl., including 30,000 bbl. for Cook County; Marquette Cement Mfg. Co., Chicago, 26 counties, 69,000 bbl.; Union Portland Cement Co., Ogden, Utah, 24 counties; Atlas Portland Cement Co., New York, N. Y., 4 counties; Continental Portland Cement Co., St. Louis, Mo., 2 counties, and the Union Sand & Material Co., St. Louis, 1 county.

Proposed Regulations for Grade Crossings

Provisions for lessening the dangers of grade crossings were recommended for legislation at a recent conference of the Public Service Commission and officials of electric railway companies, at Rochester, N. Y. The recommendations made are reported essentially as follows:

Obstructions which prevent the observance of an approach of an electric train at grade crossings should be removed or diminished.

Character of crossings should determine whether obstructions should be removed or diminished.

Obstructions on railroad property should be removed at the expense of the railroads.

Obstructions on public highways should be removed at the expense of the public authorities.

Obstructions on private property should be removed upon recommendation of the joint committee, and if they can not agree, the Public Service Commission shall decide.

Data should be acquired on the character of grade crossings for 1,000 ft. along the tracks and 200 ft. along the highways at all crossings.

Automobile horns should be standardized.

Devices on trolley cars and automobiles for signaling are as effective as the present condition of the art of signaling affords.

Trolley car whistles and automobile horns should have distinct sounds.

Trolley car motormen should be required to sound their whistles, beginning 1,000 ft. from a grade crossing and keeping it up until the head car is not more than 300 ft. from the crossing.

Headlights should be used at night, if possible, in conjunction with a reflecting device at grade crossings.

Uniformity in signaling devices for automobiles and trolley cars should be adopted.

A large stationary distance marker should be adopted. It should read, "Railroad Crossing 500 Feet Ahead," and the Public Service Commission should use arrows on the signs in its discretion.

Fifteen miles an hour should be adopted as a maximum speed at which an automobile should cross a grade crossing.

Road Improvement in Cook County, Illinois

Paving plans in Cook County, Illinois, during 1917 involve the expenditure of $800,000. The roads to be improved are the following:

Higgins Road from Mannheim Road to the county line; Wheeling Road, Glencoe to Wheeling; 95th St., Western Ave. to Keene Ave.; Keene Avenue, Archer Ave. to 119th St.; Lake Street, county line to Melrose Park Village; 147th St., 48th Ave. to Orland Village; Tinley Park Road, 147th St. to Tinley Park; Irving Park Boulevard, Wolfe Road to the city limits. Dempster Street from Evanston to Milwaukee, and Lincoln Avenue from the city limits to Morton Grove will be improved with state aid funds.

Data on the Number of Passengers Carried by Automobiles

Automobiles are carrying more passengers than the entire steam railroad system of the United States or all the urban or interurban electric railways, according to statements made by Alfred Reeves, General Manager of the National Automobile Chamber of Commerce, in a paper presented at the recent meeting of Section D of the American Association for the Advancement of Science at New York.

In support of the statement, Mr. Reeves quoted figures from the Bureau of Railway Economics showing that in 1914 the steam railroads carried 1,053,000,000 passengers an average distance of 33.6 mi. or a total of over 35,250,000,000 passenger-miles and earned a revenue of $700,400,000. There was little increase in this in 1916, it was stated. Mr. Reeves stated also that the 3,250,000 passenger automobiles now registered in the country give a passenger service of 48,750,000,000 passenger-miles, on a basis of 5,000 mi. per year per car, a conservative estimate, and 3 passengers per car. At the rate of 2 ct. per mi. this would give a service worth $975,000,000.

In 1912, the latest year for which official figures are at hand, according to Mr. Reeves, the electric railroads carried 9,500,000,000 passengers, an average distance of 4 mi. making a total of 38,000,000,000 passenger-miles. This produced a revenue of a little more than $500,000,000, averaging 1⅓ ct. per mi. At the same rate of fare the automobiles rendered a service this year of $598,500,000.

Mr. Reeves stated further that the 250,000 commercial motor vehicles in the country averaging 50 mi. a day, half of that distance with an average load of 2 tons, give a total of 3,750,000,000 ton-miles annually. Assuming 20 ct. per ton mi. as a fair average cost of hauling by horse-drawn vehicles on the public roads, this service, according to Mr. Reeves, is worth $750,000,000 a year.

West Virginia Road School

The fourth annual road school under the auspices of the University of West Virginia is to be held in Mechanical Hall, Morgantown, Feb. 6 to 16 inclusive.

The forenoon of Tuesday, Feb. 6, will be devoted to the opening exercises including the addresses of welcome and the responses. The work of the school will commence on the afternoon of Tuesday. A list of the papers, addresses and lectures follows:

Tuesday, Feb. 6—"The Engineer's Field," C. R. Jones, Dean, College of Engineering, West Virginia University.

"Our Task," A. D. Williams, Chief Road Engineer, State Road Bureau.

"Highway Locations; Best Methods and Necessary Work," Russell L. Morris, Professor of Highway and Railway Engineering, West Virginia University.

"Relation of the Road to the Farm," John Lee Coulter, Director, West Virginia Experiment Station, and Dean of the College of Engineering.

Wednesday, Feb. 7—"Right of Way and Its Problems," P. J. Walsh, Construction Engineer, Kanawha County.

"Grades," A. D. Williams.

"Road Foundations," J. Russell Wilson.

"Structural Foundations," R. P. Davis, Professor of Structural and Hydraulic Engineering, West Virginia University.

"Pavement Loading," E. L. Miller, City Engineer, Town of Bath, and Inspection Engineer, Morgan County.

"Fiftieth Anniversary of the Founding of West Virginia University—Then and Now," Dr. Purinton.

Thursday, Feb. 8—"Required Waterway," L. L. Jemison.

"Proper Location," A. D. Williams.

"Economical Designs," R. P. Davis.

"Elements that Should Control the Selection of Type of Structures," R. P. Davis.

"Bridge Floors," Mr. Cole.

"Ethics of Engineering," Blake Taylor.

Friday, Feb. 9.—"Comparison of Types of Pavements and Manners of Construction as Observed in the City of Charleston," M. J. McChesney, Assistant City Engineer, Charleston.

"Mistakes That We Should Avoid," Geo. H. Hill, Ex-County Engineer, Mercer County.

"Best Practices in Good Drainage," Prof. Russell L. Morris.

"Slides—Their Cause and Cure," A. D. Williams.

"The Ethics of Contracting," C. F. Hamilton, Contractor, Wellsburg.

Saturday, Feb. 10—"Bond Issues; Defects, Economical Types and Advantages," A. D. Williams.

"Building Roads on Borrowed Money," Edw. St. C. Smith.

"County and District Road Levies—Methods of Provision, Disbursement and Protection, Advantages and Disadvantages," G. M. Harbert.

Monday, Feb. 12—"Economical Pavement," H. B. Pullar, Chief Engineer, Pioneer Asphalt Co.

"The Relation of Solid Surfaces; Colloidal and Liquid Films," Clifford Richardson, Consulting Engineer, Barber Asphalt Paving Co.

"Sampling, Care of Samples and Tests," Prevost Hubbard, Engineer of Tests and Experiments, Office of Public Roads and Rural Engineering.

"Methods of Making Asphalt and Tar Tests; Their Relative Importance, and Reasons for Tests," Mr. Hubbard.

"Physical Tests of Materials," Mr. Hubbard.

Tuesday, Feb. 13—"By-Products of Coal," Philip P. Sharples, Manager, General Tarvia Department, Barrett Manufacturing Co.

"Tars and Tar Binders; Manners of Construction," Mr. Sharples.

"Bituminous Macadam Roads," Geo. H. Hill.

"The Importance of Careful Preliminary Estimates," Mr. Smith.

"Selection of the Type of Road for the Place," Mr. Smith.

Wednesday, Feb. 14—"Road Maintenance," Henry G. Shirley, Chief Engineer, Maryland State Roads Commission.

"Office Practice; Chart Records of Construction and Maintenance Cost," W. S. Downs, District Engineer, Monongalia County.

"Methods of Cost Keeping," E. A. Dover, Chief Accountant, State Tax Commissioner's Office, Charleston.

"Our Highway Development—Past, Present and Future," Col. E. A. Stevens, State Commissioner of Public Roads of New Jersey.

Thursday, Feb. 15—"The Proper Aggregates and Gradation for Concrete Pavement," Mr. Johnson.

"Mixing and Placing Concrete," Burdette Woodyard.

"Finishing Concrete," G. B. Arthur, Portland Cement Manufacturers' Association, Parkersburg.

"Curing Concrete," Samuel Foster, Ex-State Highway Engineer of Pennsylvania.

"Expansion," H. K. Talbott, Chief Engineer of Inspection, Universal Portland Cement Company, Pittsburgh.

"The Engineer's Place in Society," J. Hammond Smith, Professor of Civil Engineering, University of Pittsburgh.

Friday, Feb. 16—"Monolithic Brick Pavement," Will P. Blair, Secretary, National Paving Brick Manufacturers' Association.

"Tests of Clays and Brick Material Gradation."

"Kind of Brick Cushion, Sand and Cement Cushion; Kinds of Grout, Care of Pavement after Completion," Will P. Blair and Wm. C. Perkins, Chief Consulting Engineer, Dunn Wire-Cut Lug Brick Co., Conneaut, Ohio.

"Brick Veneer, Monolithic Thin Brick, Advantages and Dangers," A. D. Williams.

Outlook for Highway Work in Pennsylvania

The activities of the Pennsylvania Highway Department during the next two years will depend largely upon the legislative appropriation given it by the 1917 session of the General Assembly, according to the December issue of the "Pennsylvania Highway News."

The appropriation requested by the department is $5,000,000 for the year 1917 and a like amount for 1918, to be used in the construction and reconstruction of state aid roads. The department also asks that it be given the exclusive use of funds derived from the registration and licensing of motor vehicles, to be used for maintenance purposes. It is stated that the above with the question of apportioning the funds received to serve the best interests of the state, constitute the initial action in a new era of road development in Pennsylvania.

Federal Aid Allotments for National Forest Roads

Announcement is made of the amount allotted to each state from the appropriation of $1,000,000 to be expended during the fiscal year 1918, for constructing roads and trails within or partly within the national forests. Other information relating to the provisions of the recently enacted Federal Aid Bill may be found in previous issues of "Good Roads," pages 61, 91, 95, 99, 133, 155.

The 1918 allotments are as follows: Alaska, $46,354; Arizona, $58,604; Arkansas, $9,803; California, $140,988; Colorado, $62,575; Idaho, $108,730; Montana, $70,042; Nevada, $19,296; New Mexico, $42,495; Oregon, $128,111; South Dakota, $8,092; Utah, $41,167; Washington, $91,944; Wyoming, $40,684. A total of $9,995 has been allotted to Florida, Michigan, Minnesota, Nebraska, North Dakota, and Oklahoma. The group of Eastern States—Georgia, Maine, New Hampshire, North and South Carolina, Tennessee, Virginia, and West Virginia—in which the government is purchasing lands for national forests, receives $21,120.

Recommendations for Connecticut Road Work

Recommendations in regard to highway improvement and motor truck regulations contained in the message of Governor Marcus H. Holcomb of Connecticut presented to the joint session of the 1917 Legislature on the 3d of this month are as follows:

> We commenced to construct improved highways in this state in 1895 and their cost has caused the major part of our funded debt. We now have what is known as the trunk line system of highways with an aggregate length of about 935 mi., about equally divided between the east and west and the north and south routes as shown by the trunk line map.
>
> These highways fairly well meet public convenience, except the gaps or sections therein which have not been improved, aggregating about 50 mi. in the north and south and 30 mi. in the east and west routes. I am informed by the Highway Commissioner that it will cost about $1,500,000 to improve these sections and they should be the first to be improved.
>
> Macadam roads will not last with modern motor vehicle traffic. Any new construction should be of more durable material, and all sections of our trunk line highways should be reconstructed of more durable material as speedily as is practicable, as this will increase their usefulness and materially decrease the cost of their upkeep.
>
> But as they now are, and especially as they will be when the gaps therein to which I have referred are improved, they do and will reasonably serve such users of them as are content to keep within the limit of the reasonable and proper rate of speed provided in our statutes.
>
> In addition to our trunk line system of highways we have about 500 mi. of improved highways known as state aid highways. I am satisfied that those who have traveled over the improved highways of this and adjoining states will concede that our highways do not suffer by the comparison. As rapidly as the finances of the state and towns will warrant, there should be an extension of the state aid highways, until every town in the state will have a convenient improved highway connection with our trunk line system.
>
> It is possible, if not probable, that you will be urged by voluntary interested agents, financed by contributions by corporations within and without this state who are pecuniarily interested in the construction of improved highways and in supplying materials which enter into their construction, to make large appropriations for improved highways. This General Assembly needs no such assistance in determining the needs of the state, and I trust that you will not make appropriations for improved highways which, added to appropriations you may make for other purposes, will not leave a substantial amount to be applied in reduction of the indebtedness of the state.
>
> A reasonable limit should be placed upon the tonnage which motor trucks should be allowed to carry over our highways and bridges. I am informed that some motor trucks now carry upwards of 20 tons as a single load. Such loads are destructive of highways constructed for passenger traffic or reasonable freight traffic and impose an unreasonable burden upon the taxpayers to keep the roads in repair and to construct bridges which can stand the strain of such excessive loads. In this connection I call your attention to remarks in the Highway Commissioner's report under the caption of "Weights and Speed of Vehicles."

NEWS NOTES

Fort Wayne, Indiana, is to have a new $65,000 bridge over the St. Joseph River at State St. in that city, according to a recent report.

Ornamental Street Lighting over thirteen blocks, including Capitol Avenue, in Springfield, Ill., is a part of the plan of improvement of that city.

Cross-County Highways in Perry County, Mississippi, are to be improved with the proceeds of a bond issue of $200,000 and funds received from the federal treasury.

Contracts for 144 Bridges in Buena Vista County, Iowa, were let recently by the County Board of Supervisors. The bridges are to be built of steel or concrete and will cost approximately $150,000, according to a report.

A New Bridge at Blue Lick Springs, Nicholas County, Kentucky, will shortly take the place of the old suspension bridge across the Licking River at that point, according to a report. The new bridge will be of steel and concrete.

Douglas County, Minn., has approved a bond issue of $25,000 to $27,000 for the improvement of a county road from South Superior to Oliver. The Oliver Commercial Club has offered to furnish gravel for a certain section of the highway.

Enameled Signs for Marking the Jefferson Highway have been ordered by the Jefferson Highway Association. Each sign bears the design of a palm tree at one end and a pine at the other, with the lettering, "New Orleans to Winnipeg."

A Liberal Appropriation for Idaho Road Work will probably be made at the coming session of the legislature, according to recent advices. The legislature, which meets on January 2, will make appropriations for the work under the supervision of the State Highway Commission during the next two years.

Loose Paper from the Streets in the business section of Savannah, Ga., is being sold by the city for $3.50 per ton, according to a recent report. The paper is collected from about 150 boxes placed at convenient points in the lanes, of which there is a large number in the city. The boxes are emptied every day and it is stated that the plan has resulted in a great decrease in the amount of paper on the streets.

MEETINGS

Calendar of Coming Meetings

January 16-18.—Virginia Road Builders' Association—Sixth annual meeting, Norfolk, Va. Secretary, C. B. Scott, Richmond, Va.

January 17-20.—County Road Engineers Association of Kentucky—Meeting, Bowling Green, Ky. Secretary, F. L. Duffy, Frankfort, Ky.

January 18-20.—Idaho Society of Engineers.—Eighth annual convention, Boise, Idaho. Secretary and Treasurer, Ira F. Shaffner, Boise, Idaho.

Jan. 19.—American Society of Civil Engineers.—Special meeting for discussion of Progress Report of Special Committee on Materials for Road Construction, Society House, New York, N. Y. Secretary, Charles Warren Hunt, 220 West 57th Street, New York, N. Y.

January 20.—Western Paving Brick Manufacturers' Association—Meeting, Kansas City, Mo. Secretary, G. W. Thurston, 416 Dwight Building, Kansas City, Mo.

January 23-25.—American Wood-Preservers' Association.—13th Annual meeting, New York, N. Y. Secretary-Treasurer F. J. Angier, Baltimore & Ohio Railroad, Baltimore, Md.

February 5-9.—American Road Builders' Association—Fourteenth Annual Convention; Seventh American Good Roads Congress under the auspices of the A. R. B. A., and Eighth National Good Roads Show of Machinery and Materials. Mechanics' Hall, Boston, Mass. Secretary, E. L. Powers, 150 Nassau Street, New York, N. Y.

February 7-15.—Tenth Chicago Cement Show—Coliseum, Chicago, Ill. Secretary, Blaine S. Smith, 210 South La Salle street, Chicago, Ill.

February 8-10.—American Concrete Institute—Annual meeting, Hotel LaSalle, Chicago, Ill. Secretary, Harold D. Hynes, 1418 Walnut Street, Philadelphia, Pa.

February 19-24.—Southwestern Concrete Association—Annual meeting and show, Kansas City, Mo. Chairman of committee, Charles A. Stevenson, 1433 West 10th St., Kansas City, Mo.

American Society of Civil Engineers

A meeting of the Special Committee on Materials for Road Construction, American Society of Civil Engineers, will be held at the Society House, 220 West 57th Street, New York City, at 10 a. m., Friday, January 19, at which the progress report of the committee will be presented and discussed. The meeting follows the close of the regular annual meeting of the society, January 17 and 18, and a large attendance of engineers especially interested in road construction is expected.

American Wood-Preservers' Association

As noted in the "Calendar of Coming Meetings," the 13th annual meeting of the American Wood-Preservers' Association will be held at New York, N. Y., on Tuesday, Wednesday and Thursday, January 23, 24 and 25. The meetings will be held at the Hotel Astor.

The session at 10 a. m. Thursday, Jan. 25, will be devoted to the subject of wood block paving. Reports will be presented by the committees on Service Tests of Wood Block Paving, L. B. Moses, Chairman, and on Wood Block Paving, C. H. Teesdale, Chairman.

Municipal Engineers of the City of New York

The annual meeting and ladies' night of the Municipal Engineers of the City of New York will be held at the Engineering Societies Building, 29 West 39th St., New York, N. Y., at 8:15 p. m., Wednesday, Jan. 24.

The program will include a very short business meeting, an instrumental and vocal concert given by the Aeolian Company, a collation by Mazetti, and a dance. Admission will be by card only, cards admitting a member and ladies being issued free and those for guests and ladies at $1.50 each.

Mississippi Valley State Highway Departments

At a meeting of the Mississippi Valley State Highway Departments held at Chicago, Ill., on Dec. 9, officers were reelected as follows: President, W. S. Gearhart, State Engineer of Kansas; Secretary-Tresurer, John H. Mullen, Deputy Engineer, Minnesota State Highway Commission.

The states included in the organization are Illinois, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Nebraska, Ohio, Oklahoma, Tennessee and Wisconsin.

New Hampshire Highway Association

At a recent meeting of the New Hampshire Highway Association held at Concord, matters of general road betterment in the state, including the use of convict labor, were discussed. Authority was given O. F. Winslow, President of the association, to appoint a committee for legislative work during the present session. State Highway Commissioner F. E. Everett spoke briefly on the plans of the department for the coming season. O. J. Pelren, Manager of the Eagle Hotel, entertained the association at a mid-day banquet.

McKean County (Pa.) Good Roads Association

At the annual meeting of the McKean County Good Roads Association held at Bradford, Pa., last month, the question of a continuous highway connecting Pittsburgh and Buffalo by way of Bradford, Kane, Johnsonburg, Du Bois, and through Indiana, Westmoreland and Allegheny counties in Pennsylvania and Erie and Cattaraugus counties in New York, was favorably discussed. McKean County, Pennsylvania, recently passed a bond issue of $750,000 for county road improvement.

Officers elected at the meeting are: President, Col. A. D. Burns; First Vice President, C. S. King; Second Vice President, Charles Duke; Secretary, E. C. Carlton; Treasurer, W. H. Bunce.

A meeting of the Illinois Association of County Superintendents of Highways will be held at the University of Illinois on the afternoon of Friday, Jan. 19, at the close of the short course in highway engineering at the university.

The Federated Road Associations, recently organized in St. Louis, Mo., held a banquet at the Mercantile Club in that city on the evening of Dec. 21, at which matters of road improvement in Missouri were discussed. The principal speakers were Congressman Dorsey W. Shackleford, Assistant Attorney General T. W. Rutherford, State Highway Commissioner Frank W. Buffum and H. B. Hawes of the state legislature.

PUBLICATIONS

"THE LINCOLN HIGHWAY." Paper, 6¾x9½ in.; 46 pp., illustrated.

This publication is in the nature of a report by the Lincoln Highway Association on the progress of the work during the past year. It includes a historical sketch of the organization of the Lincoln Highway Association, a description of its method of working and a somewhat detailed review of the accomplishments of the past year and of the work done on the Lincoln Highway to date. It is illustrated by views of various sections of the Lincoln Highway and portraits of men prominent in the association.

MISSOURI, ST. LOUIS; RIVER DES PERES PLAN. Report prepared by the City Plan Commission in conjunction with departments of the city government. Cloth, 6x9 in., 38 pp.; illustrated.

This report was prepared by the St. Louis City Plan Commission in conjunction with the Department of Public Utilities, the Division of Design of the Department of the President, the Division of Parks of the Department of Public Welfare, and the Department of Streets and Sewers. It deals with a proposed plan for the development of an area along the River des Peres. The report is illustrated by a number of maps and plans, several of which are printed as folded insets.

PERSONAL NOTES

C. O. Mannes, of the Washington State Highway Department, has been appointed Deputy County Engineer of Thurston County, Washington.

Edwin Bytheway has been placed in charge of road work in Lehigh and Northampton Counties, Pennsylvania, under the State Highway Department.

J. E. Johnson, recently Inspector of Bridges and Concrete Roads of Illinois, will become Superintendent of Highways of Bureau County on Feb. 1, with headquarters at Princeton.

Henry L. Collier has been appointed Chief of Construction of Atlanta, Ga., to take effect Jan. 1. Mr. Collier was recently the Consulting Engineer of the Yellow Pine Manufacturers' Association.

A. B. Gray has resigned as Assistant Engineer, District No. 14, Pennsylvania State Highway Department, and as noted elsewhere in this column, C. E. Myers has been appointed to fill the vacancy.

C. E. Myers was recently promoted to the position of Assistant Engineer in charge of District 14 under the Pennsylvania State Highway Department in place of A. B. Gray, resigned. He was formerly Superintendent of Westmoreland County.

R. E. Chamberlain, Truck Sales Manager of the Packard Motor Car Company of New York, has been appointed Truck Sales Manager of the Packard Motor Car Company. Mr. Chamberlain will assume his new duties at the Detroit factory on January 15.

T. B. Shertzer, of the Texas Company, New York City, has become City Manager of Portsmouth, Va. He is an associate member of American Society of Civil Engineers, and was formerly Assistant Engineer of the Bureau of Highways, Philadelphia, Pa.

T. E. Hilliard, City Engineer of Marshall, Texas, died on Dec. 28.

W. J. Parkes has been appointed Highway Engineer of Jefferson County, Arkansas.

L. D. Hollingsworth was recently appointed Division Engineer of the Department of Public Roads of Kentucky, with headquarters at Paducah, Ky.

J. I. Meyers, of Milam County, Texas, has been appointed Engineer of District No. 8, in which the money received from a recent bond issue of $150,000 is to be used.

W. D. Salter, formerly Assistant City Engineer, Denver, Col., was recently appointed City Engineer of Boulder, Col. He succeeds Geo. R. Joslin, resigned.

R. H. Harrison, formerly of the U. S. Office of Public Roads and Rural Engineering, has been employed by Albemarle County, Virginia, to take charge of road construction and maintenance in that county.

R. H. Young, civil engineer, of Louisville, will superintend the work of constructing the highways of McCracken County, Ky., under the recent bond issue of $200,000. His assistants are Ramsey Bradshaw, Henry Pulliam and George Scott.

O. L. Kipp, who has had charge of road work in Redwood County, Minnesota, has been appointed by the Minnesota State Highway Commission Supervisor of Road Construction in the southwestern portion of the state, with headquarters at Hamline.

Henry Welles Durham, C. E., formerly Chief Engineer of Highways of the Borough of Manhattan, New York City, has severed his connection with Bergen County, New Jersey, as County Engineer. Mr. Durham will devote his entire time to his practice as consulting engineer with Percival Robert Moses, E.E., with offices at 366 5th Ave., New York City.

NEWS NOTES

Contracts for 57,000 Sq. Yds. of Concrete Paving have been awarded in Joplin, Mo., during 1916, according to the Portland Cement Association of Chicago, Ill.

Property Owners of Dallas, Texas, will pay for paving on sections of Leonard, Ninth, Ann and Watt Streets in that city, the cost of grading and underground work to be paid by the municipality.

According to Recent Reports from Idaho, the construction work on the North and South Highway has been commenced on a section of road between Midvale and Cambridge in Washington County.

A Paving Campaign in Hanford, Cal., has resulted in the passing of a resolution of intention to spend $200,000 on streets. A 4-in. cement concrete base with a 2-in. surface of asphalt has been decided upon, according to a recent report.

Cinders Have Been Donated by Industrial Plants of East St. Louis, Ill., for the improvement of a road in that city. Money from private donations will pay the freight on the cinders, and farmers in the vicinity have offered to construct the road.

Citizens of Washington District, Alexandria County, Virginia, recently voted for a bond issue of $122,000, the money secured from the sale of the bonds to be used for road improvement. In the Arlington District a bond issue proposal of $185,000 was lost.

The Mayor of Pittsburgh, Pa., recently presented an ordinance to the city council authorizing the changing of the name of Grant Boulevard to Bigelow Boulevard in honor of the late Edward M. Bigelow to whose energy the completion of the boulevard was mainly due.

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Plans for Road Work in Georgia

By BRUCE HALL

A five-year program for road improvement in Georgia, the carrying out of which is intended to form a network of highways over the state, connecting every county, county seat and important city and joining the national trunk lines, has been adopted by the new Georgia Highway Commission organized Sept. 19, 1916. Since the passage of the federal aid road act this is the first state to adopt a plan of road construction covering a period of five years.

In point of area Georgia is the largest state east of the Mississippi River, containing 59,475 sq. mi. Its length from north to south is 320 mi., while from east to west it measures 254 mi. Within its boundaries almost every topographical condition exists, from the rugged Blue Ridge Mountains to the dense swamps of the Okefenokee, so that in pursuing an extensive program of road improvement in the state nearly every natural barrier must be overcome.

The population of Georgia, acording to the government census figures of 1915, was 2,816,289, an increase of more than 600,000 since 1900. This increase, especially in the rural communities, has been influenced greatly by improved roads and the advent of the automobile.

TYPICAL GEORGIA SAND-CLAY ROAD.

GRAVEL ROAD IN CHATHAM COUNTY, GEORGIA.

There are 85,000 mi. of public roads in the state, of which more than 20,000 mi. are already paved with sand-clay, and several thousand miles with macadam, chert or gravel. It is traversed by the National Highway and the Dixie Highway. Another, the Bankhead Highway, to connect Atlanta, Ga., with Memphis, Tenn., and Birmingham, Ala., is proposed. The two existing highways are used annually by thousands of tourists going to Georgia and Florida in winter and returning north in the spring, and travel throughout the state is increasing from year to year.

The project covering the 5-year period contemplates the expenditure of $8,000,000. This sum includes the state's apportionment of $2,000,000 of federal government funds and $6,000,000 of state and county funds. It embraces the construction, rebuilding and improvement of 5,500 mi. of roads which will serve the greatest number of people and best promote the agricultural and commercial interests of the state.

Plans for 1917 road work contemplate the expenditure of $134,000 of federal funds—Georgia's share for the first year—and $150,000 of state funds. The state road fund is obtained from a percentage of the revenue from the sale of automobile license tags. This amounted in 1916 to $98,248.72 on the sale of 47,500 tags. It is estimated by the Secretary of State that in 1917, 60,000 tags will be sold. The road fund will be increased proportionately. It is reported that a large number of automobiles have been purchased since September, 1916. The Georgia law for non-residents is reciprocal.

The work of the Highway Department the first year will consist largely in rebuilding roads that have been worn and in linking up the unimproved stretches between cities. There are 152 counties in the state, and those sharing in this improvement already have contracted with the Highway Commission to bear their proportionate shares of the expense, the work to be done under the supervision of the highway engineers. The force of convicts for each county and its share of the 1917 automobile tax will be devoted to this purpose. Counties that are financially able will make additional appropriations for the work.

It is proposed under the commission's plan to build the roads of the most available material, at the same time requiring a standard of construction that will comply with the government specifications. There has been no generally accepted standard for the material used in road construction in Georgia, for many of the rural counties could not afford to build the more expensive types of roads. But there are some highways that will compare favorably with any in the country; for example, the macadam roads of Fulton County, the shell roads of Chatham County on which three Grand Prize automobile races and two Vanderbilt Cup races were run, and the sand-clay roads of Muscogee County.

The Georgia plan contemplates a continuation of the convict labor system through a cooperative arrangement. Since 1908, when the convict lease system was abolished, the convicts have been apportioned to the counties according to population. They have built practically every mile of paved road in the state. Coincident with the creation of the Highway Commission, the legislature changed the method by which convicts are to be distributed, beginning Jan. 1, 1917. Under this method the convict force is prorated according to the public road mileage in each county, to better enable the rural counties to cooperate with the Highway Department in carrying out the road building program. There are 7,000 convicts in the state, 6,000 of whom are engaged in road building. The state is spending $2,500,000 annually in maintaining its convicts on road work, and it is estimated that their labor is worth $5,000,000 to Georgia. An estimate of 85 ct. a day is placed upon the value of convict labor. This estimate was reached by averaging the cost of maintenance in each county. The United States Department of Agriculture has been asked to make this allowance on all projects submitted.

When the commission announced its intention to utilize convict labor on road work partly financed by the federal government, there was some doubt as to whether the Department of Agriculture would approve this method. The question has been discussed and it is not expected that any projects submitted will be rejected for this reason.

When the legislature amended the act regulating the distribution of convict labor to a prorata based on post road mileage, some of the larger counties which would not receive as many prisoners under the new law as they had received on the basis of population enjoined the state from enforcing the law. But it is not expected that this litigation will hamper the commission in carrying out its program. Heretofore many counties having a large number of convicts have cooperated with adjoining counties having fewer prisoners, in road construction. For example, Chatham County built the "Bryan Causeway" with its prisoners, Bryan County furnishing the material. Fulton County has aided other counties on a similar plan where the improvement was for mutual benefit. In general the counties are showing a splendid spirit of cooperation, and are organizing along the routes to pledge their support of the commission's plan. By the methods given above the Highway Commission expects to complete its program.

The Georgia Highway Commission was created by an act of the legislature Aug. 16, 1916. It is composed of T. E. Patterson, Chairman; E. L. Rainey and R. E. Davison, Members of the Prison Commission; Dr. S. W. McCallie, State Geologist; C. M. Strahan, Professor of Engineering at the University of Georgia; R. D. Kneale, Professor of Engineering at the Georgia School of Technology; G. H. Yancey, Secretary. The Prison Board was included in the Highway Commission because it has control over the distribution of state convicts.

Ceramic Materials in Highway Construction[*]

By W. W. MARR[†]

Any discussion of the relative merits of materials for construction leads invariably to delicate or even perilous situations. Especially is this true when disinterested observers have the temerity to press their views or opinions on a well-informed audience among which might be found some strong partisans. I, therefore, approach the subject with great timidity, not that I fear offense may be taken where none is meant but rather that I seriously doubt my ability to express my thought.

We are of one accord—all of us—in demanding results; and theories are but a means to an end. But Oh! how difficult it is to produce results—satisfactory results—"to deliver the goods!" There are so many factors involved that it seems as if there were always a slip somewhere. We are not usually judged, however, with due consideration for the difficulties we have encountered but on the contrary we are, in the final analysis, credited with success or failure, according to the manner in which the bare facts impress those who pass sentence.

This discussion must not become pessimistic, though, for the viewpoint of the writer is exactly the opposite.

Right here it may be well to say a word regarding the wonderful progress made by the material interests of our state in promoting the use of their products. I refer particularly to the methods employed and note with growing satisfaction and approval that the strong tendency is away from the old practice of advocating the use of a particular material to meet all requirements, regardless of its suitability and only because its sale brings profit to its promoter. The day of the "dirt pavement" has passed. This is now frankly admitted by the most selfish and shortsighted of our producers. I say "shortsighted," because there is nothing to my mind which in the past has been a greater drawback to road improvement than the confusion created in the public mind by the unscrupulous tactics of promoters who devoted the greater part of their energy to villifying their competitors. There was some excuse for this, however, in that competitors very generally used common weapons but I am glad to say that I do not know of any large interest using the old methods. They have by common consent, as it were, abandoned such practices and have come to realize that to meet the demands for materials suitably selected to fulfill economically and satisfactorily their purpose will tax them all to their full capacity.

In harmony with the "eternal fitness of things" it has come to pass that while the material producers in the past were themselves largely responsible for the slow development of road improvement, they are now a most potent factor in promoting the cause. The reason for their success is simple. It is because the public is now, greatly through their efforts, being informed of the facts. They are conducting great educational campaigns and adding much weight to their arguments by subordinating or eliminating the directly selfish motives and concentrating their efforts on teaching the need of better highways. They employ large forces of the best available men to preach the doctrine of better roads, to study their products, to improve their value and to see that a work once started is done as well as it can be done with the present knowledge of the subject. The inspectors employed by producers are instructed to investigate the methods of construction involving the use of their material in any particular work and to report back any fault found in order that it may be corrected through proper officials. Notwithstanding the fact that engineers realize to a greater or less extent their own limitations, criticism of their work is seldom welcomed and is often resented as an affront to either their knowledge, ability or integrity. Correcting bad practice is a difficult task and should, for the benefit of all interested, be entrusted only to those especially qualified through experience, tact and knowledge of human nature to handle it.

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[*] Paper presented at the dedication of the Ceramic Engineering Building at the University of Illinois, Urbana, Dec. 6-7, 1916.

[†] Chief State Highway Engineer, Illinois State Highway Commission.

Many disinterested persons will unhesitatingly say that the determination of the type of improvement should be left to the engineer and yet when their own pocket books are affected, will immediately distrust either his ability or sincerity. The reasons for this are many. In the first place experience teaches that we must look after our own pocket books. Then more or less conflicting data are always to be had and this naturally confuses us. We think, or attempt to think, and in our futile effort to grasp in a moment what would take years to learn, it is small wonder that we jump to conclusions. After all, ours is a government by representation and in view of the admitted success of this form, it would appear that the power to determine the type of a public improvement should be, as it is, vested in representatives duly elected. Let them secure such information and advice as they will and on the whole we will have little cause for complaint. The engineer in a broad sense, is a director of effort and a scientific expert in the knowledge of the use and abuse of materials, their value, quality and limitations. His function is, I take it, to present in a fair and impartial way his acquired knowledge of actual facts to those who have to construe these facts and who, in the light of other factors which may enter the proper solution and of which they presumably have knowledge, have power to act.

It strikes me that it is unbecoming of an engineer, as such, to urge the use of a material of construction. To illustrate, let us take, for example, a city pavement. What engineer is as well qualified to determine the significance of noise, for instance, as a factor entering into the selection of the proper type of pavement for a given street, or to determine the relation between cost and benefit to the property assessed, as the representative of the district? In a locality where materials for construction are produced, is it not often good business to use the home products providing the cost is commensurate with the value of the resulting pavement?

Of course the country road furnishes a very different problem from that of the city street. Fewer factors enter the determination of the proper type of pavement in the former than in the latter. It would seem that the type of country road is almost purely a commercial problem and such factors as noise and aesthetic features are given scant consideration while minimum cost of service under conditions obtaining is of the most vital importance.

By cost of service I mean the unit cost per vehicle per mile per year, or on some similar basis. This cost is divided into first cost, interest cost and maintenance cost. One is as important as another. It may be noted here that the problem of life of pavement disappears from state aid roads in Illinois as the law now stands. This law provides for maintaining a satisfactory surface regardless of type and all there is of interest remaining is cost of service. Who cares about the type as long as the surface is smooth, satisfactory and serviceable? What road traveler will not enthuse over the merits of any type which serves his purpose and which he finds in good condition for an appreciable distance? How many drivers of all sorts of vehicles will abandon a paved surface for an earth road in good condition? As long as a satisfactory surface is maintained it is well-nigh impossible to arouse any public interest in either types or cost of service. It, therefore, behooves us to give maintenance the consideration it merits.

I have little to say concerning the relative merits of concrete and brick highways. I don't know much to say. I confess I have never since known half as much as I did the day I received my degree in college. I do not say this in an idle attempt to occupy neutral ground, or in a futile endeavor to straddle the question, but rather because I realize perhaps more keenly by reason of intimate association with the work the immense possibilities that are still in store for us. I do know, however, that while there is much unlearned or yet unknown about either type, there have recently been improvements and developments in each that are little short of marvelous. I do know that there are many examples of good and bad pavements of any type—notable successes and miserable failures. I do know that many of the failures cannot be satisfactorily explained or rather that there are many plausible explanations for any one case and that neither concrete nor brick pavements are by any means fool proof.

Concrete pavements are enjoying a most remarkable popularity and have been in use long enough to demonstrate beyond question their value in the scheme of road improvement. I do not share the misgivings of those who point to the cracking of concrete roads, because I believe that with the providing of reasonable maintenance, the cracks are of comparatively little significance.

Brick pavements have always been popular and are more popular now than ever before. The new type of monolithic brick is receiving material favor and seems to offer immense possibilities. I regard proper grouting of the brick as of prime importance and believe that with a well drained and settled roadbed, the thickness of concrete base for brick pavements is of little significance. Heavy loads do not make an appreciable impression on ordinary dry earth roads and from this I take it that the earth itself sustains the load, provided it is settled and dry. The problem then seems to be to keep the earth under the brick pavement in a dry condition after it has once settled by properly waterproofing it. This is accomplished by a perfect grout filler. Perfection is also necessary to insure stability in the structure.

In choosing between concrete and brick, I should consider carefully the availability of materials, the relative costs and the character and amount of traffic the road might be expected to bear.

Bridge Building in Chicago, Illinois

The estimated costs of bridges to be erected in Chicago during 1917 are as follows: Twelfth St., $1,200,000; Wells St., $650,000; Franklin-Orleans St., $600,000; Lawrence Ave., $130,000; North Kimball Ave., $31,000; South Kedsie Ave., $25,000.

Bridge Building in Fayette County, Iowa

Unusual activity has prevailed in the bridge building department of Fayette County, Iowa, during the past season, according to the "Service Bulletin" of the Iowa State Highway Commission. This activity has been partly due to the necessity for performing a large amount of extra work which was not anticipated when the 1916 plans were formulated. On June 1 a number of bridges were destroyed as a result of a cloudburst which flooded the Turkey and Volga Rivers, causing a loss to Fayette County on five tributary streams of approximately $50,000. The work of replacing these structures and repairing others was immediately undertaken and was completed Nov. 1. They are of the arch, deck girder, through girder, and pony truss types, ranging in sizes from 30 ft. to 60 ft. and costing from $2,000 to $7,085.

In addition to this work the county carried on its regular bridge building program, which included the building of new structures in other than the devastated sections to an amount, including repairs, of $64,821. The total expenditure of the county for the year of 1916 will approximate $112,293. Of this amount $58,393 was for work done by contract, and $37,000 for work done by day labor.

The Need for Highway Engineering Courses in Civil Engineering Curricula of Western Colleges[*]

By T. R. AGG[†]

If there were a general agreement among educators relative to the factors that may be recognized as constituting a legitimate educational need, it would be a comparatively easy matter to determine what courses should be offered. Probably most educators subscribe to certain broad principles of engineering education that enable them to eliminate those things that are properly trade school subjects or that partake of the nature of fads.

The engineering profession is extending its activities and influences into many new fields and as a result educators are constantly being urged to introduce courses pertaining to these new lines. If heed were given to all such suggestions curricula would become a bewildering maze of uncorrelated courses in which the student would wander aimlessly for the allotted time. No educator has to my knowledge ever seriously questioned the wisdom of requiring of engineering students a large amount of work in the fundamental sciences; and faculties should sedulously guard against any encroachment on the time needed for the subjects.

Civil engineering curricula ordinarily include a few studies that cannot be classed as indispensable because of their inherent value as mental stimulants. Such subjects as roads and pavements, water supply, sewerage and railway bridge design are examples. The basic principles of each of these subjects should be covered in a well balanced course in civil engineering, but none can be said to be indispensable, and the relative time given to each may be varied considerably without impairing the value of the training the student receives from the group.

Engineering education must keep pace with the progress of the engineering profession and to do so new courses must be provided as soon as there is a well defined need for them. This emphasizes again the desirability of some standard by which to measure proposed courses in order to determine which of them may be added without impairing the value of curricula and with the assurance that the new courses will serve a definite and desirable educational purpose.

College faculties are now confronted with precisely such a situation because of the trend toward specialization in the field of civil engineering which is typified by the disposition to include courses in highway engineering in civil engineering curricula. Before faculties are justified in so doing, it would seem that they should be assured that there is a clearly defined need for such courses.

It is submitted that such a need is established if it can be shown that:

1. Engineers in considerable number are wanted for positions in highway work and that these positions give promise of enduring.
2. For a number of years students in sufficient numbers will desire to avail themselves of the opportunity to enroll in courses in highway engineering.
3. The compensation to be expected in highway engineering is commensurate with that in other fields of engineering.
4. The professional opportunity is such as to indicate that the highway engineer may look forward to a career of usefulness and one in which he may do real service for society.
5. Courses in highway engineering may be introduced into civil engineering curricula without displacing courses of greater value in developing logical thinking and mental resourcefulness.

The inquiries that come to the western colleges for engineers to fill positions in highway work show that a demand for such men already exists. These inquiries are received from state, county and municipal highway departments, from consulting engineers and from contractors. During the past two years the opportunities for employment in highway work have steadily increased in number and a survey of the field seems to indicate that the highway engineer can reasonably expect permanent employment in that field.

In the state of Iowa more than two hundred highway engineers are employed by the various officials having jurisdiction over rural highways and several other western states employ as large a number. This number is, however, considerably in excess of that at present employed by most of the western states and is merely an indication of the number of highway engineers that will be required when the states give to highway improvement the necessary attention.

It is generally stated that the college graduate should first be placed in a subordinate position, there to undergo a period of seasoning under the guidance of an older and more experienced engineer before he is intrusted with authority or given responsibility. In recent years many college graduates who have obtained employment with highway departments have been put into responsible positions as inspectors or superintendents of construction within a few weeks of their graduation. This is not recommended, but is made necessary by the very rapid increase in the volume of highway construction. On this account employers are asking the college for men who have had some instruction relative to the special problems encountered in highway construction. Few of the western states are doing more than make a small beginning in the solution of their highway problems, and the volume of highway construction is certain to increase at a rapid rate, especially in the west, where the mileage of public highways is so great. Along with that increase will come the more insistent demand for engineers for highway work.

Students in considerable numbers will register in highway engineering courses if such are offered. This is shown by the inquiries that are received from prospective students and from students who have registered in civil engineering, who wish to do major work in highway engineering. In the institutions with which the writer is familiar, these do not constitute a large group, but the number is increasing each year. This points clearly to the fact that many students have weighed the matter and have concluded to fit themselves to enter the field of highway engineering. Students of this class are certain to become much more numerous in the near future, particularly if the exceedingly rapid expansion in highway construction continues, with the consequent increase in the number of engineers employed.

Already many students find summer employment in highway work and thus learn of the opportunities in that field and this leads some of them to direct their energies towards fitting themselves for that particular class of engineering work.

The colleges might not be justified in providing courses in highway engineering by the fact that men find ready employment in that field nor by the further fact that a certain percentage of students wish to enroll in such courses. The establishment in the colleges of courses in plumbing or brick laying might be justified on precisely the same grounds, but no one is likely to advocate such action.

Before a college is warranted in providing specialized courses it would seem that the proposed specialization should prepare the student for a field that affords adequate professional opportunity. Highway engineering, however, offers the possibility of high professional attainment.

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[*] Paper presented before Section D, Engineering, American Association for the Advancement of Science, New York, N. Y., Dec. 28, 1916.

[†] Professor of Highway Engineering, Iowa State College.

The cities and towns of the western states are annually contracting for what is in the aggregate a very large mileage of pavement and the need for competent engineers in connection with that work is urgent. In the past this has not been a particularly inviting field for ambitious men on account of the uncertain tenure of office, the relatively poor pay, and the political nature of the administration. Conditions in these respects are steadily improving and as the effects of a scientific management of public improvements become apparent, the movement to employ properly trained engineers will spread with increasing rapidity.

A large amount of the street improvement is being carried out in cities and towns that employ no permanent engineering corps and must, therefore, secure non-resident engineers for their work. Too often the character of the engineering indicates either ignorance or disregard of many of the recently established but generally accepted principles of highway design. Because of the poor construction, the loss of money and service to such cities is enormous and the continuation of such mistakes can be prevented only by employing engineers who are familiar with the principles of highway engineering and who are conversant with the best practice.

The casual observer sees many defects in the prevailing systems of rural highway administration and in the roadway surfaces constructed. The trained observer has become convinced that there exists a very pressing need for greater efficiency in handling the public funds appropriated for highway construction and for the exercise of greater care in the selection of types of roadway surfaces and in their construction.

No concerted effort to encourage the employment of the technical expert in highway work can succeed until there has been established a reasonably stable supply of men of the requisite training.

The establishment of efficient administrative systems for municipal and for rural highway construction; the selection of suitable types of roadway surfaces; the design and construction of roads and pavements; the maintenance of costly improvements, all are technical problems of great complexity and their proper solution presents to the highway engineer a professional opportunity of high order.

The highway system of the nation is now recognized as an indispensable public utility and as such it must be improved and maintained in a high state of efficiency. Who shall say that participation in that development does not offer a professional opportunity comparable with that of the sanitary engineer, the structural engineer or the mechanical engineer, each of whom may enjoy unquestioned professional standing?

The pecuniary reward that may be anticipated by the highway engineer compares favorably with that enjoyed by engineers in other fields. College graduates are usually able to secure positions in highway work at a beginning salary of $75 per month with expense allowances when away from headquarters. County engineers receive from $900 to $5,000 per year. State engineers from $2,500 to $10,000 per year. The tenure of office is already as certain as in many other engineering fields and conditions are sure to improve in this respect because the public is beginning to realize that constant change in the personnel of a public office is costly and that men should be retained as long as their services are satisfactory.

Courses in highway engineering may be introduced into most civil engineering curricula without displacing any subject more valuable as general training. The highway instruction that can profitably be given to undergraduate students will not require to exceed ten or twelve semester hours. If this is distributed through two or three semesters it can be accommodated readily.

If it may be conceded that a college is justified in a utilitarian attitude toward its functions, which is the spirit of many western colleges, there are strong reasons for taking cognizance of the need for highway engineering courses.

The inclusion of highway courses in civil engineering curricula will be the means of bringing the opportunities of the highway field to the attention of students and will give them an opportunity to become familiar with the rudiments of highway engineering practice before they seek employment. Some students thus interested will after graduation continue their studies along highway lines and enter a professional career of great service to the public, and of profit to themselves.

The faculties of western engineering schools have for several years been aware of the trend toward a greater recognition by the engineering profession of the field of highway engineering and the consequent tendency to urge upon educational institutions the establishment of courses intended as special preparation for highway work. This situation has been met in various ways according to the convictions of the administrative authorities. Some have declared uncompromisingly against any specialization whatever, others have provided in the civil engineering curricula, a highway option or a few elective courses in highway engineering and in a few instances faculties have gone to the extreme of establishing a four-year course in highway engineering.

The question of the advisability of permitting specialization may be debatable as an educational policy, but that principle has already been tacitly approved. Mechanical engineering courses and the professional practice of the mechanical engineer differ from electrical engineering courses and the professional practice of the electrical engineer less than sanitary engineering courses and the practice of the sanitary engineer differ from highway engineering courses and the practice of the highway engineer. But most of the well established educational institutions of the United States offer mechanical engineering and electrical engineering as separate courses, with appropriate degrees.

There is, therefore, some precedent for the establishment of highway engineering options or elective courses in civil engineering curricula, once it is apparent that such courses will serve an adequate educational purpose.

If it be conceded that an educational need is established by the fulfillment of the conditions outlined above, then there is a need for highway courses in the civil engineering curricula of western colleges. A demand for engineers to fill positions in highway work already exists and a survey of the field indicates that this demand will increase. The prediction may be entertained that under normal conditions the engineer may enter the field of highway engineering with the expectation of making it his life work. The compensation he may expect compares favorably with that in other lines of engineering. The professional opportunity is particularly attractive because of the magnitude of the problems involved and the possibility for great public service. The institution of highway courses imposes no insurmountable obstacles and need not impair the value of long established curricula.

Highway engineering courses will open the doors upon new opportunities for college graduates; will be in keeping with the progress of the engineering profession; will eventually insure better returns to the public for money expended for highway improvement and will, therefore, be a wise educational policy.

In South Dakota Every Fourteenth Person owns an automobile, according to recent reports. County expenditures during the past year ranged from $396 to $117,000, and records appear to show that the greatest improvement in roads has occurred in sections frequented by tourists.

Methods of Tar Surface Treating Macadam Roads

Detailed data on the methods of applying tar surface treatments to macadam roads were given in a paper entitled "Some Advantages of Refined Coal Tar for Road Construction and Maintenance," presented at the recent convention of the American Association of State Highway Officials by Philip P. Sharples, Manager of the General Tarvia Department of the Barrett Company. According to Mr. Sharples the success of applying surface treatments to water bound macadam has within the past few years led to the use of this type for the roads of lesser traffic.

The choice of bituminous materials for such work, according to Mr. Sharples, lies between those which form distinct mats on the surface and those which are thin enough to enter into the aggregate and form an integral part of the roadway. Care must be exercised, however, to avoid the formation of a mat which will rut and roll under traffic.

Excellent examples of such mats built with tar, Mr. Sharples stated, can be seen in the vicinity of Boston, Mass. There is a section of the Newton Boulevard opposite the Brae Burn Club which was treated in this way in 1906 using ¾ gal. of refined tar per sq. yd. of surface. This road has never received a second treatment, and although it carries a heavy automobile traffic "probably represents as low an upkeep cost for a road kept in perfect condition as any in the United States." The traffic, however, according to Mr. Sharples, consists wholly of motor-driven vehicles. Other examples of this type of road are a Massachusetts state highway at West Lynn, treated in 1907, and the Metropolitan Parkway through Everett and Revere, treated in 1906.

The use of cold applications, Mr. Sharples stated, has to a large extent replaced the use of hot applications in this work. The reason assigned by him for the wider use of the cold application is that the work requires less skill and is cheaper. The method to be followed in work of this kind was described by Mr. Sharples as follows:

"The amount of bituminous material required will usually vary from ¼ gal. per sq. yd. for re-treatments to ¾ gal. per sq. yd. for new absorptive roads. The most favorable results on a first treatment can be obtained by supplying sufficient bituminous material to cause a slight excess to remain on the surface after it has been allowed to dry in for an hour or so. Usually better results are obtained on new work by applying in two treatments at an interval of two to six hours.

REVERE BEACH BOULEVARD—SURFACE TREATED WITH TAR IN 1907

"The kind of cover to be used depends largely on the local material available. With the refined tars, success may be obtained with a large variety of materials from ¾-in. stone chips through the gravels to a fine though sharp sand. Materials containing clay are barred as its presence tends to cause disruption of the surface through the emulsifying properties of clay and water on bitumens.

"On roads of over 4 or 5% grade, coarse, hard covers should be chosen, in order to prevent slipperiness. The marked success of large-sized hard stone in the cover is nowhere better shown than in Maryland where grades up to 10% have been successfully treated. The stone used has been a ¾-in. clean chip.

"The cost of these surface treatments varies with freights

A MASSACHUSETTS STATE HIGHWAY, AT WEST LYNN—TAR SURFACE TREATED IN 1907

NEWTON BOULEVARD, NEWTON, MASS.—SURFACE TREATED IN 1907

and localities, but the contract prices in Maryland showing a total cost of between 6 and 7 ct. per yd. give a good idea of the cost of doing work carried out on a large scale with power trucks, in the best possible manner, using stone chips for cover."

Present Status of Physical Tests for Granite Blocks*

By CLARENCE D. POLLOCK†

All tests which have been devised for granite intended for use in granite block pavement are more or less unsatisfactory except the service test. Until a very few years ago, the test of actual service was the only one used for the purpose of determining the desirability of the different granites for paving. Then a number of cities began applying either the compression test or the toughness test and some used both.

The American Society of Municipal Improvements at its convention in Wilmington, Del., in October, 1913, inserted a clause in its standard specifications for granite block which read as follows:

> The granite shall preferably be such as will give above 20,000 lb. per sq. in. crushing strength, combined with a uniform structure and toughness. The toughness shall be not less than 11 as determined by the method employed by the United States Department of Agriculture, Office of Public Roads.

At the convention in Boston in October, 1914, the above was changed to a minimum crushing strength of 20,000 lb. per sq. in. and the toughness was reduced from 11 to 9. Then at the Dayton, Ohio, convention in October, 1915, the crushing strength test for granite was omitted, because, in the words of the committee report, "it has been proven by many tests and by service that the crushing strength of a granite has very little bearing on its value as a pavement."

The test for "French Coefficient of Wear" was substituted for the crushing strength test as being nearer to the service conditions. The test requirements then read:

> For heavy traffic the granite shall have a toughness of not less than nine (9) and a "French coefficient of wear" of not less than eleven (11). For medium traffic, the granite may have a toughness of not less than seven (7) and a "French coeffcient of wear" of not less than eight (8) if a cement grout filler is used. The above tests shall be made by the methods described in Bulletin No. 44, U. S. Department of Agriculture, Office of Public Roads. The average of three (3) tests shall be used for determining toughness and the average of six (6) tests for determing the "French coeffcient of wear."

At the Newark, N. J., convention of the American Society of Municipal Improvements, October, 1916, these tests as adopted at Dayton the previous year were again adopted without change.

While these tests are far from perfect, yet they are the best now in use after the service test. Great care should be used in carrying out the details of these tests exactly as is done in the Office of Public Roads in the U. S. Department of Agriculture at Washington, D. C. For example, in getting the "French coefficient of wear," if irregular pieces of granite, such as are obtained from a crusher, are taken, the results obtained will be very different from those obtained if the pieces are gotten by breaking the stock to approximate cubes as is done at Washington. Because of this lack of attention to details a great deal of trouble and expense is often caused, and it tends to discredit the test when one laboratory gives a sample a high rating and another gives the same granite a low one.

Because of this uncertainty in tests, many engineers do not specify any, but simply use blocks from quarries which have furnished good granite for paving purposes previously as proven by the actual test of traffic.

At present various engineers are working along different lines in an endeavor to devise a test or tests which will more nearly approximate the actual traffic conditions, but in an accelerated form.

The idea of using the crushing strength test evidently crept in from its use in selecting building stones. It has very little, if any, relation to the conditions to which the granite will be subjected after it has been incorporated in the pavement, and hence it is not a satisfactory index to the desirability of various granites for paving blocks. There are many granites with a comparatively low crushing strength which have made most excellent pavements, when properly laid, and there are granites with very high crushing strength which have not proved suitable for paving purposes. A few engineers still hold to this test, but it has been pretty generally discarded.

The impact test for toughness seems to be nearer the actual condition in the street, but it is nevertheless far from being an ideal test. It is necessary that many more samples be subjected to this test and a careful study made of the results before final judgment can be safely passed upon the merits of this test.

While the test for the "French coefficient of wear" was originally intended to determine the availability of a granite or other stone for use in macadam pavements, yet many of the features which are desirable in a stone for macadam are also desired in granite for paving blocks. Altogether too few tests have been made as yet to prove conclusively just how valuable this test may be in selecting granites for paving blocks. A study of the small number of tests available in connection with the impact tests on the same granites rather indicates that these two tests taken together are an improvement in the right direction.

There is a good field for experimental work in this matter of tests of granite for paving blocks. The test should be one which causes an effect on the block or test piece as closely resembling the effect of actual traffic on the pavement as possible, but sufficiently intensive, so that ready measurement may be made of the effect after a short period. Until such a test is put in practical form, those engineers who do not require tests, but use granites from quarries which have proved satisfactory in the past, will continue to get pavement as good as or better than do those who specify numerous tests for the stone.

Franklin County, Texas, Roads are to be improved with the proceeds of a recently approved bond issue amounting to $75,000. The bonds are to run for 40 years and bear interest at the rate of 5%.

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*Paper presented before Section D, Engineering, of the American Association for the Advancement of Science, New York, N. Y., Dec. 28, 1916.

†Consulting Engineer, New York, N. Y.

Economic Phases of State Highway Legislation[*]

By **ARTHUR H. BLANCHARD**[†]

Highway appropriations are authorized for the construction of highways which will be of value to the state as a whole in the development of travel and its natural resources, industries, agricultural interests and civilization.

Generally speaking public highways are not built to the satisfaction of all of the citizens whose taxes are being used for the work. As a rule the administration and engineering organizations having control of this work are alone held responsible, but if conditions in any state, county, or municipality are thoroughly investigated, it will be found, in many cases, that others than the officials and engineers should bear some of the responsibility when construction and maintenance work on the public highways is not done efficiently and economically.

It is well known that the construction of a great mileage of highways requires a large organization of thoroughly educated and experienced highway engineers, and that such an organization cannot be developed over night.

In connection with this problem it is practicable to derive valuable suggestions from practice in foreign countries. In France the people and the servants of the people realized many years ago the advantages accruing from the establishment of a permanent organization of efficient, well trained highway engineers, and there was created the renowned Department of Roads and Bridges of France. The British public also realized that in order to secure a dollar's worth for every dollar expended, it was necessary to put the control of its public works under men trained in a profession directly dealing with every economic and engineering phase of public improvements, and there was inaugurated the practice of requiring applicants for a given municipal or county position to have attained a grade of membership in the Institution of Civil Engineers of Great Britain commensurate with the responsibility of the particular office sought. For many leading municipal and county positions it is required that the applicant shall hold the highest grade of membership in the Institution; for less important posts associate membership is required. It would seem desirable to take a similar step in this country by requiring a certain grade of membership in the American Society of Civil Engineers and a certain number of years of experience in highway work for certain highway officials.

A highway engineer encounters many obstacles in the development of an efficient engineering organization. There is continual interference in the legitimate work of the development of a highway department. An illustration is the unfortunate application of the worn-out residence qualification now in force in the New York highway law requiring inspectors of construction to be residents of the county within which the highway to be constructed is located. Under this it is impossible to secure the most capable man from civil service lists.

Many are familiar with the demand that highways be built without allowing sufficient time to carry on the investigations of local conditions absolutely necessary in practically every case if proper work is to be done. In few instances is there granted a fifth of the time required.

The demand for mileage results in pressure for the building of cheap roads. Appropriations for given routes are often not large enough to build types of pavements suitable for the traffic to which the roads will be subjected in a few years. The former New York State Department of Efficiency and Economy recommended that all sections of highways properly designated as state and county highways be built on cement concrete foundations, and that only first class wearing surfaces should be used. While the acceptance of this recommendation would increase the cost of construction per mile, it is obvious that it would give the state, at the termination of the life of the bonds under which the highways are constructed an asset in the grading, drainage, and permanent foundation, and for at least 25 years satisfactory wearing surfaces, if properly maintained.

State commissions doubtless have been unduly influenced in the consideration of the requisite width of improved surface of many trunk highways by the demand for immediate construction of large mileages. Here again the former State Department of Efficiency and Economy presented recommendations which spell ultimate economy for the state. These were that many of the trunk highways be built 18 and 20 ft. wide instead of only 16 ft. As far back as 1908 the First International Road Congress adopted a resolution that: "There should be but one roadway for every kind of vehicle, proportioned to the intensity of the traffic, 19 ft. 8 in. (6 m.) wide, at least." The main county highways of England have an improved surface 20 ft. wide and the main trunk highways of France are practically 24 ft. in width. In view of the rapid development of touring car, motor truck and motor-bus, traffic it is obvious that the surface suitable for traffic should be wider than 16 ft. Few people realize the traffic to which our trunk highways will soon be subjected. Over one hundred motor-bus routes are today in operation within the state of New York. In some cases the motor-buses carry as many as 40 passengers, have a horse power rating of 75, weigh, loaded, as much as 8 tons, and have an over-all width of 90 in. It is well-known that when meeting motor trucks and motor-buses, having widths of nearly 8 ft., it is necessary to turn out on soft shoulders to avoid a collision on a 16-ft. roadway.

If public highways are to be economically constructed and efficiently maintained, adequate legislation covering the utilization of highways by horse-drawn vehicles, touring cars, motor trucks, trailers, motor-buses, and traction engines is absolutely necessary. These regulations should cover the operation of all types of vehicular traffic, permissible loads per lin. in. of width of tire, and width, length, and height of vehicles. This should be enforceable by the state and not left, as at present in New York, to the control of town and county officials.

At last the people of the United States are beginning to realize that to receive value for money expended in the construction of highways, it is necessary that the highways be efficiently maintained. Some method must be devised for annual legislative appropriations of sufficient funds for proper and economical maintenance. Legislature after legislature has followed the usual procedure of discounting the estimates submitted by highway departments, and hundreds upon hundreds of miles of state highways are improperly maintained, in many cases because of a lack of funds. The fact must be accepted that as years go on the financial burden of maintenance will be increased, due partly to additions to the mileage of improved highways. It should be borne in mind also that if maintenance is curtailed in one year to the extent of $500,000, and miles of highways are left unrepaired, the necessary appropriations in the following year to repair the damage to the highways not maintained may amount to a million or more dollars. In other words, many types of construction wear very rapidly after they first begin to deteriorate.

In Omaha, Nebraska, the Slab Top of a Reinforced Concrete Storm Sewer has been utilized as the base for a street pavement. The sewer is 17 ft. in width, inside measurement, and about 11 ft. in depth. The walls are 18 ins. in thickness and on top is a slab of about 1 ft. 10½ ins. depth at the center. The roadway is 22 ft. wide between curbs with a 16-in. gutter on either side, the curbs and gutters being of concrete built as monoliths. The wearing surface of the pavement consists of 2 ins. of asphaltic concrete.

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[*] Abstract of an address at the annual meeting of the Poughkeepsie Automobile Club, Poughkeepsie, N. Y., Dec. 4, 1916.

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Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

JANUARY 20, 1917

PRELIMINARY STREET WORK

Expensive street widening projects, alterations in line and grade at large cost, and the tearing up of pavements in order to install, alter or repair subsurface structures are of everyday occurrence. The expenditure of money is not the only undesirable feature of such work nor is it always the greatest. Inconvenience to traffic, interference with the business of establishments along the street—even danger occasionally—are accompaniments of work of this character. In the case of pavement cuts the damage often continues for a considerable time after the work has been completed because of neglect to replace the pavement properly.

Much of the work of this character—perhaps the major portion of it—could be avoided by the careful design of streets, the establishment, on the ground, of lines and grades, and the performance of the subsurface construction and at least a portion of the grading before the development of the abutting property. While it is not always possible to forecast accurately the character and population of a given district nor the traffic over a given street or street system, these factors should be studied most carefully and given due weight in designing.

The street systems of most American cities are very largely the result of haphazard growth. Even where comprehensive plans have been made the results are not always satisfactory; nor can good results be expected from planning alone. The most thorough and carefully prepared plans, filed in the city archives, are of little use unless reinforced by ordinances to prevent encroachments and to otherwise regulate land subdivision and the erection of buildings.

Proper regulations governing real estate developments are effective preventives of costly readjustments of lines and grades after business or residence districts have been built up. Streets laid out for the purpose of subdividing large tracts of land eventually must be added to the existing street system of the city. Ordinarily such streets are planned to divide the tract in the manner most profitable to the promoters, and little, if any, attempt is made to coordinate them with the city plan. Every municipality should possess—and exercise—a supervisory power over such layouts and should accept only those streets which are laid out in such a way as to conform to the general street plan and so designed as to meet present traffic requirements and anticipate future conditions. This obviously presupposes the existence of a city plan and an engineering organization competent to look after the municipality's interests.

Before any pavements, curbs or sidewalks are laid the lines and grades should be finally established and work should be completed on subsurface structures, including, so far as possible, all service connections. The results of the neglect of these precautions are very apparent in the cities and towns of this country, especially in the older ones. Buildings are put up too close to the right of way, or, not infrequently, actually projecting into the street, with the sills of varying heights, some of them below the grade of the street. Such conditions not only detract from the appearance of a street and the value of property, but also inflict upon the municipality heavy costs for damages when readjustment can no longer be postponed.

The evils of pavement cuts are too well known to require more than passing mention.

The burden of devising ways and means for remedying conditions such as have been noted falls upon the engineer, but he is seldom able, except indirectly, to prevent their existence. He can do something, however, and his knowledge of the difficulty and expense of reconstruction in built-up localities obligates him to use whatever influence he may have to bring about better administrative methods.

THE RIGHTS AND OBLIGATIONS OF THE PEDESTRIAN

A city's streets are provided as means of communication for the residents of the city and others who may be present on business or pleasure; and, as such, are expected to accommodate various kinds of traffic. Each of these kinds—excepting, of course, fire apparatus, ambulances and similar traffic to which special privileges have to be granted—supposedly has equal rights. By custom, and sometimes by laws or ordinances, however, certain portions of the streets are devoted primarily to certain kinds of traffic, which, on those particular parts of the street, ordinarily have right of way.

With the enormous number of vehicles using some city streets it is inevitable that there should be accidents. At the same time it is a fact that a considerable proportion of these accidents could be avoided. As large numbers of the killed or injured are pedestrians, it is pertinent to consider the causes of accidents and the practicable methods for reducing their number.

A safe rule for the use of the streets is the old one that the rights of any individual or class extend to just that point at which they interfere with the rights of another individual or class—and no farther. Unfortunately, this rule is not applied to everyday life by all individuals; there are always those who will not govern their own actions by it. And for some reason—perhaps one traceable to the days when foot traffic was the only means of communication—the most frequent and flagrant disregard of the rights of others is by pedestrians. The driver of a horse or an automobile keeps on that part of the road designed for his use, if he can, unless some emergency makes it necessary to encroach upon the sidewalk—the pedestrian's portion. But many pedestrians have no such scruples; they not only expect the exclusive privilege of the sidewalks, but apparently feel that they have the right of way in all parts of the street. Examples of this are the habit of crossing from one sidewalk to the other between crossings and the failure to exercise proper care on crosswalks.

It is probable that a large proportion of the street accidents involving pedestrians are due solely to the recklessness of the pedestrians themselves, and that a still larger proportion is due partly to lack of caution on the part of people on foot. There is a marked tendency for public opinion to put the burden of proof upon the driver of a motor car in case of accident; but this is unfair. There are a relatively few careless and incompetent drivers, but the majority observe both the rules of the road and the rights of others.

Pedestrians are in greater danger in cities than in the open country where there are seldom either sidewalks or crosswalks, yet they exercise less care in the cities. Thousands cross every day at protected crossings in New York City when vehicular traffic has the right of way and they are encroaching upon the rights of that traffic by their action. Others use unprotected crossings without a glance to either right or left; they also throw upon others the entire care for their own safety. Smaller numbers cross the streets wherever they happen to, without regard to crossings, and so add to the burden of looking out for others that every operator of a motor-driven vehicle has to bear.

The right of the pedestrian to use the roadway where no sidewalk is provided and his right to a reasonable degree of freedom in crossing from one walk to the other can not be questioned. Neither is there any doubt that it is his duty to do his share in the avoidance of accidents.

Pleasure cars and motor trucks are comparatively new vehicles and it is natural that some time should be required for traffic to adjust itself to the new conditions they impose. Such adjustment will come, but it must come through the cooperation of all users of the roads, and foot traffic must do its part.

Responsibility of the Consulting Highway Engineer[*]

By H. V. HINCKLEY.[†]

"It is not all of life to live" nor is it all of paving to pave; in proof of which I call your attention to just a few points of a possible many.

Every engineer should know whether rolling an embankment in 6-in. or 12-in. layers, as is usually specified, will produce the maximum settlement which must be obtained where a bank with flood water up over its shoulders is to stand up and hold the paving to grade.

Every engineer who has watched the development of railroad ballasting during the past 30 years should know whether elasticity is preferable to absolute rigidity.

Every engineer of experience should know that, under any ordinary concrete specifications, he can build two slabs side by side, using the same sand, the same cement, the same proportion, the same time of mix in the same machine, and at the end of 90 days have one slab at least twice as strong as the other. And as this is the concrete age, possibly no point could be mentioned which, in the matter of economy, is more important than this one. Why build a concrete slab 7 in. thick if one can be built 5 in. thick under the same specifications that will be just as strong? It is quite possible for a competent engineer, on this point alone, to save the county from five to ten times the amount of his fee, and yet you will find an occasional commissioner who would employ a cheap, inexperienced engineer.

Every engineer who recommends a sand cushion under a brick pavement should be able to explain fully the advantages of the cushion.

Every engineer should know that in a brick pavement absolute uniformity of brick is essential. Specifying that a certain percentage of second class brick may be slipped in is criminal.

Every engineer should know that, next to maximum strength, the important element in concrete pavement, or in concrete base for pavement, is the joint where the ends of the slabs must be strengthened without exposed armor.

Every engineer should know that if he has the actual flood flow for a five, ten or twenty year period, there is a constant by which to multiply to obtain the maximum flood flow of the future, which maximum, in general, should be used in determining waterways in permanent road construction; but he should also know there will be cases where even a permanent state highway should, on the ground of economy, be built lower than the maximum high water.

Every engineer should appreciate the fact that he is supposed to have brains and should so use them that the taxpayers will get not full value for the cost of the engineering, but many times full value. To the great majority of taxpayers a fill is a fill, concrete is concrete and paving is paving. To determine when concrete is not concrete and when permanent pavement is not permanent, are only some of the responsibilities that rest upon the shoulders of the engineer.

While every rule has its exceptions, every engineer should know that, in general, he—not the contractor—should be responsible for the results. Any engineer who attempts to shun the responsibilities which he should assume; who attempts to leave the details of construction to the contractor and hold him under bond for maintenance for a long term of years, is not worthy of the title of engineer.

Texas Paving Statistics in 1916

A statement recently issued by the Texas Company, of Houston, Texas, gives the total amount of permanent paving accepted by 29 cities of the state from January 1, 1916, to January 1, 1917, as follows:

Cities	Square Yards	Miles
San Antonio	314,244.36	18.670
Dallas	149,399.80	7.770
El Paso	144,899.13	5.020
Taylor	123,591.94	7.680
Houston	123,563.85	5.220
Corsicana	109,101.50	5.940
Fort Worth	79,342.00	3.809
Austin	69,645.08	[illegible].758
Beaumont	65,133.00	4.020
McKinney	56,840.00	4.010
Corpus Christi	51,291.81	2.760
Mineral Wells	44,002.94	2.690
Wichita Falls	38,582.92	1.436
Amarillo	35,836.00	1.440
Hillsboro	35,538.00	2.450
Bryan	32,066.00	1.520
Highland Park	25,882.00	1.470
Clarksville	19,600.72	1.030
Paris	17,366.70	1.150
Sherman	14,643.12	1.060
Temple	12,098.60	.760
Pittsburgh	11,845.00	.580
Denison	11,606.00	.680
Terrell	11,350.00	.680
Denton	8,677.00	.290
Marshall	8,664.00	.600
Niles	4,264.00	.260
Galveston	3,211.40	.140
Waco	2,283.00	.180
Total	1,624,569.87	86.073

The kinds and amounts of pavement put down during the same period are shown as follows:

Kind of Pavement	Square Yards	Miles
Asphaltic concrete	458,535.34	25.600
Bitulithic	333,642.49	14.351
Uvalde rock asphalt	199,317.71	11.500
Vertical fiber brick	149,928.08	7.920
Asphaltic macadam	123,402.20	7.490
Vibrolithic	102,131.00	5.250
One course reinforced concrete	64,112.59	3.850
Two course reinforced concrete	44,328.11	1.960
Oklahoma rock asphalt	43,158.00	2.480
Creosoted wood block	39,492.27	1.306
Granitoid	22,253.88	1.860
One course plain concrete	15,745.00	1.310
Warrenite	13,291.00	.610
Sheet asphalt	10,883.00	.406
Standard brick block	4,348.20	.180
Total	1,624,568.87	86.073

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[*] Paper presented at a meeting of the Oklahoma Society of Engineers at Tulsa, Okla., Dec. 27-28, 1916.

[†] Consulting Engineer, Oklahoma City, Okla.

The kinds and amounts of pavement removed are given below.

Kind of Pavement	Cities	Square Yards	Miles
Standard brick	Houston	46,141.30	2.900
	Fort Worth	27,549.00	.826
	Dallas	1,136.80	.040
Asphalt macadam	Wichita Falls	9,750.00	.386
	Dallas	600.00	.030
Westrumite	Dallas	8,990.50	.420
Dolarway	Waco	777.00	.070
Total		94,944.60	4.672

Short Course in Highway Engineering at the University of Kentucky

A short course in highway engineering is to be given at the University of Kentucky, Lexington, Feb. 5 to 10. The course, which is the fourth held by the University, will be given under the auspices of the College of Engineering and the State Department of Public Roads, and will be under the direction of the Highway Engineering Department of the university. It will consist chiefly of lectures, the majority of them being followed by discussions. The course is open to all who are interested and there are no fees.

Among the technical papers are the following: "Location and General Surveying for County Roads," by F. L. Duffy, Assistant State Highway Engineer of Kentucky; "Alignment, Grades, Cross Sections, Curves and Crowns," by W. J. Carrel, Professor of Bridge Engineering, University of Kentucky; "Drainage and Foundation," by C. R. Thomas, Division Engineer, Kentucky Department of Public Roads; "The Construction of Earth Roads," by a representative of the U. S. Office of Public Roads; "Maintenance of Earth Roads," by L. T. Haney, Division Engineer, Kentucky Department of Public Roads; "Highway Organization," by Russell Gaines, County Road Engineer of Jefferson County; "Construction of Macadam Roads," by T. B. Smith, Division Engineer, Kentucky Department of Public Roads; "Reconstruction of Macadam Roads with Water Bound Macadam," by W. A. Obenchain, Division Engineer, Kentucky Department of Public Roads; "The Maintenance of Macadam Roads," by a representative of the U. S. Office of Public Roads; "Construction of Gravel Roads," by W. S. Canning, Division Engineer, Kentucky Department of Public Roads; "Maintenance of Gravel Roads," by L. D. Hollingsworth, Division Engineer, Kentucky Department of Public Roads; "Contracts and Specifications," by a representative of the U. S. Office of Public Roads; "Brick Roads Illustrated," by Will P. Blair, Secretary, National Paving Brick Manufacturers' Association; "Construction of Concrete Roads," by M. D. Ross, Division Engineer, Kentucky Department of Public Roads; "Bituminous Macadam Roads," by S. M. Murry, Asphalt Expert, Fayette County; "Possibilities of Kentucky Rock Asphalt," by Col. M. H. Crump, Highway Engineer, Bowling Green; "Bituminous Surface Treatment," by R. W. Davis, Road Engineer, Fayette County; "Design and Construction of Small Steel Bridges," by Walter E. Rowe, Dean, College of Civil Engineering; "Concrete and Its Use in Culverts and Bridges," by C. D. Franks, Portland Cement Association, Indianapolis, Ind.; "Design and Construction of Steel Bridges, Span 40 Feet and Up" and "Type of Structures Best Adapted to Highway Bridges and Culverts," by C. D. Snead, Bridge Engineer, Kentucky Department of Public Roads; "Inspection, Care and Maintenance of Highway Bridges," by W. J. Carrel; "Surveying for Bridge Site, Inspection of Foundation, Including the Design for the Foundation Other Than Solid Rock," by Rodman Wiley, Commissioner of Public Roads of Kentucky.

Besides these lectures, there will be a number of addresses on general subjects connected with highway work including "A Review of State Aid Work," by Commissioner Wiley; "Better Roads in Kentucky," by Henry S. Barker, President of the University of Kentucky; and "Road Building and Engineering Problems," by Commissioner Wiley.

The program for the afternoon of Thursday, Feb. 8, provides for an inspection of bituminous roads recently built in Fayette County, and on Thursday evening there will be a reception by the Brooks Engineering Society.

Saturday, Feb. 10, is designated as demonstration day. If the weather permits there will be a demonstration of road building at the university grounds.

The course is under the direct charge of D. V. Terrell, Professor of Highway Engineering at the University of Kentucky.

Governor Sleeper of Michigan Recommends Road Maintenance

In his message to the Legislature of 1917, Gov. Sleeper refers to the development of public highways in Michigan as follows:

"The development of our public highways is proceeding rapidly and efficiently. If defects exist in the so-called Covert Act, passed by the last legislature, steps should be taken to remedy it and make it immediately effective. The larger number of petitions filed under this act shows the great demand for it. The upkeep of our highways, especially those built with state aid, is a matter which does not receive the consideration it deserves. It is a waste of public moneys to allow these valuable roads to wear out so rapidly, in most instances before they are paid for, and particularly when but a small expense is needed to maintain them. They must be kept up and if the local communities will not give them the required care, the state should be permitted to do so and to charge the expense back to the neglectful districts up to the amount of state aid received."

Winter Traffic on the Dixie Highway

Non-resident automobile traffic from northern states to points in Florida by way of Jacksonville during the month of December exceeded one hundred cars a day, according to a report of the Chairman of the Duval County (Florida) Dixie Highway Council. This does not include the number of cars bound for the West Coast and central Florida, which entered the state through Tallahassee, Monticello, Live Oak and Lake City. January reports indicate that the number of foreign cars on every section of the highway in Florida is many times greater than in previous years at this time.

The various committees along the Dixie Highway, recognizing the value of completing the road for its entire length, are working to secure the cooperation of counties and others in improving certain "gaps" in the highway, the most notable of which exist on the eastern division between Cincinnati, O., and Knoxville, Tenn., on the western division between Nashville and Chattanooga, Tenn., on the central division between Waycross, Ga., and Jacksonville, Fla., on the western division between Tallahassee, Fla., and Gainesville, Ga., on the connecting link between Tallahassee and Jacksonville, and on the eastern division between Jacksonville and Miama, Fla. It is hoped that these sections may be improved and ready for the fall travel of 1917.

Work in Sacramento County, Cal., on the $1,750,000 highway system will be in progress in the early spring, according to a recent report. It is expected that by the middle of February a sufficient portion of the route will have been surveyed to warrant the letting of contracts.

Mirrors Have Been Used on Two Dangerous Curves on a section of road in the Municipal Mountain Park of the City of Denver, Colo. The mirrors are 5 ft. in width and 3 ft. high, and are carried by iron pipes cemented into the rock at the edge of the road. Heavy copper covered wooden frames are used to hold the glass and protect it from moisture. Each mirror cost about $50 in place, and to guard against damage the Denver Motor Club offers a reward of $25 for information leading to the conviction of any one damaging or defacing the mirrors.

MEETINGS

Calendar of Coming Meetings

January 23-25.—American Wood-Preservers' Association.—13th Annual meeting, New York, N. Y. Secretary-Treasurer F. J. Angier, Baltimore & Ohio Railroad, Baltimore, Md.

Jan. 31-Feb. 2—Ohio Engineering Society—Annual meeting, Ohio State University, Columbus, O. Secretary, John Laylin, Norwalk, O.

February 5-9.—American Road Builders' Association—Fourteenth Annual Convention; Seventh American Good Roads Congress under the auspices of the A. R. B. A., and Eighth National Good Roads Show of Machinery and Materials. Mechanics' Hall, Boston, Mass. Secretary, E. L. Powers, 150 Nassau Street, New York, N. Y.

February 7-15.—Tenth Chicago Cement Show—Coliseum, Chicago, Ill. Secretary, Blaine S. Smith, 210 South La Salle street, Chicago, Ill.

February 8-10.—American Concrete Institute—Annual meeting, Hotel LaSalle, Chicago, Ill. Secretary, Harold D. Hynes, 1418 Walnut Street, Philadelphia, Pa.

February 19-24.—Southwestern Concrete Association—Annual meeting and show, Kansas City, Mo. Chairman of committee, Charles A. Stevenson, 1433 West 10th St., Kansas City, Mo.

March 5-6—National Paving Brick Manufacturers' Association—Annual convention, Hotel McAlpin, New York, N. Y. Secretary, Will P. Blair, Cleveland, Ohio.

March 5-7—American Ceramic Society—Annual meeting, Hotel Astor, New York, N. Y. Secretary, Edward Orton, Columbus, O.

American Road Builders' Association

In arranging the program for the Seventh American Good Roads Congress to be held in Mechanics Building, Boston, Mass., Feb. 5-9, under the auspices of the American Road Builders' Association, the committee in charge has selected a number of leading subjects and has decided to devote an entire session or a definite part of a session to the consideration of each topic. Each will be introduced in a formal paper prepared by a leading authority, and the subject will then be open for discussion by the delegates. Among the subjects to be treated at the various sessions are the following:

Bituminous Roads and Pavements and Treatments (Sheet Asphalt—Bituminous Macadam—Bituminous Concrete, etc., etc.)
Cement Concrete Roads and Pavements
Stone Block Roads and Pavements
Wood Block Roads and Pavements
Brick Roads and Pavements
Traffic—Its Effect on Design, Construction and Maintenance and its Regulation.
Contractors' Plant or Equipment
Earth, Gravel, Sand-Clay and Miscellaneous Roads and Pavements.

Among the papers which have been selected to be read during the convention are the following:

"Policy and Program of Government in Road Construction under New Federal Aid Law," Logan Waller Page, Director, United States Office of Public Roads and Rural Engineering.

"Best Practice in Concrete Road Construction," H. E. Breed, First Deputy Commissioner, New York State Commission of Highways.

"Recent Practice in Granite Block Pavements," Wm. H. Connell, Chief, Bureau of Highways and Street Cleaning, Philadelphia, Pa.

"Recent Practice in Wood Block Pavements."

"Best Practice in Brick Pavement Construction," F. R. Williams, Paving Engineer of Cleveland, O.

"Traffic Census; Its Application to the Design of Roadways, Selection of Pavements and Traffic Regulation," D. B. Goodsell, Assistant Engineer, Department of Public Works, Borough of Manhattan, New York, N. Y.

"Earth and Gravel Road Maintenance," R. L. Morrison, Professor of Highway Engineering, Agricultural and Mechanical College of Texas.

The tentative program calls for the opening of the Eighth National Good Roads Show on Monday, Feb. 5. The registration of delegates and visitors will proceed during the day.

The first session of the congress will be called to order in the convention hall at 11:00 a. m., Tuesday, Feb. 6, by the President of the American Road Builders' Association. Governor S. W. McCall of Massachusetts and Mayor James M. Curley of Boston will welcome the delegates to the state and city, respectively. Other addresses will be made by Col. Wm. D. Sohier, Chairman of the Massachusetts Highway Commission, Charles F. Weed, President of the Boston Chamber of Commerce, and George W. McNear, President of the Bay State Automobile Association. President A. W. Dean will make the response for the Association.

A particularly interesting feature of the convention will be the "Question Box." Questions to be discussed must be handed in at the registration booth not later than noon on Wednesday, Feb. 7.

On Tuesday evening, beginning at 7:30, an entertainment and smoker will be given by the Massachusetts Highway Association at Convention Hall, on the corner of Garrison and St. Botolph Sts. The annual dinner of the American Road Builders' Association will be held at the Hotel Copley-Plaza at 7:00 p. m. on Wednesday.

The reports of committees will be presented at a business meeting of members of the Association at 4:30 p. m. on Thursday, Feb. 8.

American Concrete Institute

The 13th Annual Convention of the American Concrete Institute, as previously noted, will be held at the Hotel La Salle, Chicago, Ill., on Thursday, Friday and Saturday, Feb. 8, 9 and 10.

The session of chief interest to road builders, according to the preliminary program, will be that at 8 p. m. on Friday, Feb. 9. Among the papers and committee reports scheduled for that session are the following: Report of the Committee on Concrete Roads and Paving, Chairman A. N. Johnson, Portland Cement Association, Chicago, Ill.; "Essentials for the Successful Construction of Concrete Highway," by William M. Acheson, Division Engineer, New York State Highway Department; "Condition of the Wayne County Concrete Roads," by A. N. Johnson, Portland Cement Association; "Experience in Construction and Maintenance of Concrete Highways in California," by Austin B. Fletcher, State Highway Engineer of California; "Maintenance of Concrete Roads in Connecticut," by Charles J. Bennett, State Highway Commissioner of Connecticut; "Some Recent Developments in the Construction of Concrete Roads," by William M. Kinney, Engineer, Promotion Bureau, Universal Portland Cement Co.

At the session at 2 p. m. on Saturday, Feb. 10, the report of the Committee on Reinforced Concrete Highway Bridges and Culverts will be presented by its chairman, Prof. C. B. McCullough of the Oregon Agricultural College. At the same session a paper, entitled "Lessons From Culvert and Bridge Failures," will be presented by Thomas H. MacDonald, Ames, Iowa.

Minnesota Surveyors' and Engineers' Society

The annual convention of the Minnesota Surveyors' and Engineers' Society will be held at the Radison Hotel, Minneapolis, Feb. 7, 8, and 9.

The officers of the society are: President, F. W. McKellip, Faribault, Minn.; Vice-President, B. James Reynolds, Redwood Falls, Minn.; Secretary and Treasurer, W. F. Rosenwald, 300 Shubert Building, St. Paul.

PERSONAL NOTES

C. W. Hubbell has been appointed City Engineer of Detroit, Mich., succeeding R. H. McCormick.

W. O. McCluskey, Jr., has been appointed County Road Engineer of Ohio County, West Virginia, taking effect Feb. 1.

Page Jackson has been appointed County Road Engineer for Somerset County, Maryland, in place of L. A. Brodie, resigned.

D. S. Humphrey, of Cleveland, O., has been elected President of the Ohio Good Roads Federation, to succeed the late Jesse Taylor.

F. Walters, City Engineer of Manhattan, Kan., for the past four years, died recently from injuries received in an automobile accident.

R. F. McClellan, of the Board of Supervisors of Los Angeles County, Cal., has been placed in charge of the Highway and Bridge Department.

R. C. Terrell, formerly Commissioner of Public Roads of Kentucky, has become Professor of Engineering at the University of Oklahoma, Norman, Okla.

C. J. McGiffert has been appointed Acting Town Engineer of Montclair, N. J., succeeding E. S. Closson. Mr. McGiffert was formerly Assistant Town Engineer.

J. L. Stephens, formerly Assistant City Engineer of Mishawaka, Ind., has been appointed City Engineer in place of C. W. Cole, who has resigned to enter private business.

A. E. Christhilf, former Chief Engineer of the Commissioners for Opening Streets, of Baltimore, is reported to be the head of a new paving company, organized in that city.

Ross McClave, Consulting Engineer, of New York City, has been appointed to succeed Henry Welles Durham, who recently resigned as County Engineer of Bergen County, New Jersey, as previously noted in these columns.

A. R. Young, City Engineer of Topeka, Kansas, has resigned to enter the employ of the John Baker, Jr., Asphalt Distributing Co., of Chicago, Ill. Mr. Young has been City Engineer of Topeka since 1910, previous to which time he was City Engineer of Chanute, Kan.

William M. Acheson, who has been Division Engineer of the New York State Highway Commission since October, 1913, has resigned to become Chief Engineer of the Crescent Portland Cement Co., of Wampum, Pa. He has been identified with public work in New York State and elsewhere for a number of years.

C. W. Cole, City Engineer of Mishawaka, Ind., has resigned to become an officer of the Midland Co., construction engineers.

James C. Wonders has been appointed District Engineer of the United States Office of Public Roads and Rural Engineering with jurisdiction over the states of Iowa, Kansas, Missouri and Nebraska, under the federal aid act of July 11, 1916. Formerly Mr. Wonders was State Highway Commissioner of Ohio.

R. W. Acton, a member of the State engineering force, St. Paul, Minn., has been appointed Road Engineer of St. Louis County, with headquarters at Duluth. He will have authority for making a complete survey of the county road system and the employment of a sufficient number of engineers to carry out an extensive road building program, involving the expenditure of $1,225,000. His salary is $4,500 a year.

Charles H. Sweetzer, District Engineer of the United States Office of Public Roads and Rural Engineering, has opened his headquarters in the Federal Building, Berkeley, Cal. His work is the administration of funds allotted to California, Nevada, Arizona and New Mexico, under the federal aid act. The total apportionment to the four states for the fiscal year is $362,711. The work has begun in California on portions of state highway routes in Contra Costa, San Mateo, Ventura and Placer Counties.

NEWS NOTES

Keokuk, Iowa, Will Pave About Three Miles of Streets with vitrified brick during the coming spring, according to a report.

Scour from Culvert Ends on Embankments has been guarded against by an ingenious method in Contra Costa County, California. On a recent road job where corrugated iron culverts on a sidehill road discharged on a fill, flumes made of semicircular sections of the culvert metal were installed to conduct the water from the ends of the culverts to the bottoms of the banks, where it could do no damage.

Portland Cement Shipments During 1916 approximated 94,508,000 bbl. as against 86,891.681 bbl. in 1915, an increase of 8.8%, according to statistics and estimates prepared by the United States Geological Survey. The increase in output was 6.1%, or 91,194,000 bbl. compared with 85,914,907 bbl. in 1915. There was a decrease of 28.9% in the stock of finished cement in 1916. The next highest record for shipments of Portland cement from the mills was in 1913—88,689,377 bbl.—but the returns so far received show that the year 1913 still leads in production with 92,097,131 bbl. Six new plants each in a different state reported production of Portland cement during 1916.

A Reinforced Concrete Arch Design for Reconstructing the Galveston Causeway, large portions of which were destroyed by the storm of August, 1915, was recently accepted by the board of engineers. Five separate traffic interests will use the structure, namely, three railroads, one electric interurban line, and Galveston County, and each was represented in the proceedings leading up to the final adoption of the arch plan. This plan, calling for a 60-ft. arch span, was submitted by William Mueser, of the Concrete Steel Engineering Co., of New York City. A design for a 30-ft. girder and slab structure was submitted by J. L. Harrington, of Harrington, Howard & Ash, consulting engineers, of Kansas City, Mo. Among so many interests the difficulty of reaching an agreement resulted in prolonged controversy. It was finally decided to submit the plans to a board of arbitration which consisted of Prof. A. N. Talbot of the University of Illinois, Prof. Geo. F. Swain of Harvard University, and Lincoln Bush, Consulting Engineer, of New York City, with the result as stated above. According to the report of the board, the estimated cost of reconstruction under the arch plan with certain modifications will be $1,376,000, with an additional $140,000 for repairs to the Galveston approach. It was estimated that the cost of the girder design would be $141,000 greater, and the former plan was considered by the board less expensive, the better structure, and the one most suited for the conditions.

EQUIPMENT — TRADE — MATERIALS

New Selling Organization of the Lakewood Engineering Co.

The Lakewood Engineering Co. of Cleveland, Ohio, has recently announced that the Lakewood line of contractors' equipment, the Owens-Wylie concrete chute systems, and the Milwaukee and Wisconsin concrete mixers and street pavers will be sold by the Lakewood Engineering Co. under one sales management. The personnel of the new organization is as follows:

Charles F. Lang, President, Lakewood Engineering Co.; N. F. Teschan, President, Milwaukee Concrete Mixer Co.; Roy G. Owens, Manager, Contractors' Equipment Dept.; Lloyd Brown, Manager, Car Dept.; W. A. Mesdick, Assistant Manager, Car Dept.; H. Walter Sykes, Manager, Electrical Industrial Equipment; W. G. Grail, Manager, Clamshell Bucket Dept.; V. Truelson, Chief Engineer, Milwaukee Plant; James Lockhart, Chief Engineer, Car Dept., Cleveland; Thomas D. Maley, Chief Engineer, Contractors' Equipment, Cleveland; Henry T. Pleines, General Supt., Cleveland.

The slogan of the new organization will be "Link up with Lakewood."

"Handbook on Wood Preservation"

The above is the title of a handbook recently issued by the American Wood-Preservers' Association, in which, according to its foreword, are presented "facts and figures" for those who are interested in the subject. Further information, it is stated, will be furnished by officers or members of the association. Divisions of the subject of wood preservation treated under separate heads, are as follows:

Decay, Preparation and Treatment—Chronicle of Wood Preservation—Progress—Processes — Preservatives — Manufacturers of or dealers in wood preservatives—Uses—Manufacturers of Wood-Preserving Equipment—Users of Preserved Wood—Wood-Preserving Plants, corrected to Jan. 1, 1916. Besides a bibliography of wood preservation, it contains the constitution of the American Wood-Preservers' Association with list of officers and committees for 1916 and a list of members corrected to Dec. 1, 1916. The book is 6¼x 9¼ in. in size, bound in cloth, and contains 73 pages, with diagrams and maps.

New Catalog of the American Cement Machine Co., Inc.

The new catalog of "Boss" concrete mixers and other machinery has recently been issued by the American Cement Machine Co., of Keokuk, Iowa. The catalog consists of 32 pp. and covers and contains detailed descriptions of the equipment handled by the company. The line included comprises stationary and portable mixers, large and small size special mixers for street work, hoists, back-fillers and pumps.

Notes

The Cleveland Trinidad Paving Co. has announced the removal of its offices to 886, The Arcade, Cleveland, O.

The Good Roads Machinery Co., Kennett Square, Pa., recently sold to the supervisors of Mead Township, Warren County, Pennsylvania, road machinery to the value of $2,850. This consisted of a combination steam roller, two dump wagons, and a Climax Jumbo road machine, to be delivered by March 1.

The Georgia Vitrified Brick & Clay Co., of Augusta, Ga., has become a licensee of the Dunn Wire-Cut Lug Brick Co., of Conneaut, Ohio. The former also has a plant at Campania, Ga.

The annual convention of the Garford factory sales representatives and factory branch managers was held recently at the plant of the Garford Motor Truck Co., at Toledo, Ohio. About fifty of the company's representatives were in attendance and all reported a growing demand for trucks. One of the most encouraging features of the meeting from the company's standpoint, according to reports, was the number of repeat orders reported by the men. It is stated that the company has decided to double its output during 1917.

PUBLICATIONS

PIPE AND THE PUBLIC WELFARE, by R. C. McWane. Cloth, 5x7½ in., 165 pp.; illustrated. The Sterling Press, 318-326 West 39th street, New York, N. Y. $1.00.

In this book the subject is treated in four chapters, as follows: Chap. I, Historical; Chap: II, Materials and Methods of Making Metal Pipe; Chap. III, Some Technical and Historical Data on Metal Pipe Deterioration; Chap. IV, Wood Pipe. The book is well printed on paper of excellent quality and is very completely illustrated by halftones showing pipes of various kinds, their manufacture and uses.

BRIDGE MANUAL, CONTAINING STANDARDS, GENERAL INFORMATION AND INSTRUCTIONS. Bulletin No. 3, Office of the Oregon State Highway Commission. Prepared under the direction of State Engineer John H. Lewis. Paper, 4½x7¼ in., 154 pp.; illustrated.

Included in this bulletin are resumes of the laws governing bridge work in Oregon; instructions for bridge work including surveys, construction and inspection; sections on defects in bridges, tests, prices, the life of bridges, standard plans, painting and other features of bridge work, and standard specifications for bridges of various types. The illustrations consist of halftones showing bridges of correct design and bridge failures, and plans and diagrams for designing.

NEWS NOTES

The Lincoln Circuit Marking Association, with headquarters at Danville, Ill., has been organized in eighteen counties of the state for the purpose of marking the roads over which Lincoln traveled during his career as a lawyer in what was known as the eighth judicial circuit between 1841 and 1858. Besides the markers, bronze tablets containing the names of judges and lawyers who used the roads in that circuit are to be erected in each county seat.

The Detroit-Chicago Paved Way which, as planned, will follow the Old Territorial Trail through Ypsilanti, Ann Arbor, Chelsea, Jackson, Albion, Marshall, Battle Creek, Kalamazoo, Paw Paw, Dowagiac, Niles and South Bend, will be completed during the next five years, according to recent advices. A 2-mile section of the road west of Battle Creek was opened to the public on Nov. 30. This is 16 ft. wide, paved with concrete. Calhoun County has already passed a $800,000 bond issue, the money from which will be available in 1917 for constructing the road in that county, and the work will begin without delay. Bond issue proposals of large amounts will be submitted to the voters of Kalamazoo and Cass counties, and the question of following Calhoun County's example, is also being considered by other counties through which the route passes.

GOOD ROADS

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Stone and Concrete Foundations from the Standpoint of Efficiency and Economy[*]

By GEORGE C. WARREN[†]

"Economy and efficiency" have come to be used together as a high-sounding expression of which one almost stands in awe. According to the dictionary definitions, each of these words describes the same qualities, hence using them together adds nothing to the meaning of either. To my mind the meaning of "economy and efficiency," in the most extreme application of that term, is well expressed in the one word "best"—when that word is used in its broadest sense of "all things considered."

An engineer who would say that any particular type of road or pavement foundation or surface was "best" or "most efficient and economical" under all conditions would be like an architect who claimed that either stone, brick, concrete or lumber was the best building material under all conditions. Such an architect would be considered incapable of giving sound advice from the point of view of either true economy or true efficiency.

The subject upon which I was requested to speak was "Broken Stone vs. Cement Concrete Foundations from the Standpoint of Efficiency and Economy." This seems to imply, like a lawsuit, that there is room for argument on two sides but that there is only one right side. I have, therefore, slightly changed and broadened the title to "Stone and Concrete Foundations from the Standpoint of Efficiency and Economy."

The question of what is the "best" or most "economical and efficient" paving foundation for any particular case necessarily entails, in my judgment, a careful consideration of the conditions in that case, including the character of the subsoil, the character of the traffic to be carried, the type of wearing surface to be laid on the foundation, and climatic conditions. In regard to new pavement, I believe that a statement, made by the company with which I am associated, in its instructions issued some 15 years ago and used continuously since then, covers the ground as well as it could be covered in a few words. This is as follows:

SAND FILL ON OREGON APPROACH TO THE INTERSTATE BRIDGE BETWEEN PORTLAND, ORE., AND VANCOUVER, WASH.

FINISHING BROKEN STONE FOUNDATION FOR BITULITHIC PAVEMENT ON SAND FILL SHOWN IN ILLUSTRATION OPPOSITE.

> Subsoil—An unyielding foundation is essential. Our specifications for Bituminous Base (Form B) are designed for characters of sub-soil which can be rolled to provide a firm sub-foundation. Where unyielding sub-soil conditions do not exist, or where the roadway is so narrow or contains such obstructions as to make proper rolling of foundation impossible, the use of hydraulic concrete (Form C Specification) is recommended, being very careful that the concrete is roughened as specified. It frequently occurs, and cannot always be foreseen, that different portions of the same street, with a view to economy and utility, require different thicknesses as well as characters of foundation; for this reason it is advisable that specifications should provide for payment for the foundation per cubic yard, and prices for both bituminous and hydraulic concrete foundation.

During the 15 years which have elapsed since the formulation of the foregoing rule, I have seen nothing to indicate that it is not absolutely correct as between crushed stone and hydraulic cement concrete foundation, except as noted hereafter in regard to sandy subsoil under certain conditions. On the other hand, I have seen many cases of misjudgment in the use of crushed stone foundations where subsoil and other local conditions indicated that such a foundation should not have been used, and also the adoption of expensive concrete foundations under conditions that made the selection of that type contrary to true economy.

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[*] Abstract of a paper presented before Section D, Engineering, American Association for the Advancement of Science, New York, N. Y., December 28, 1916.

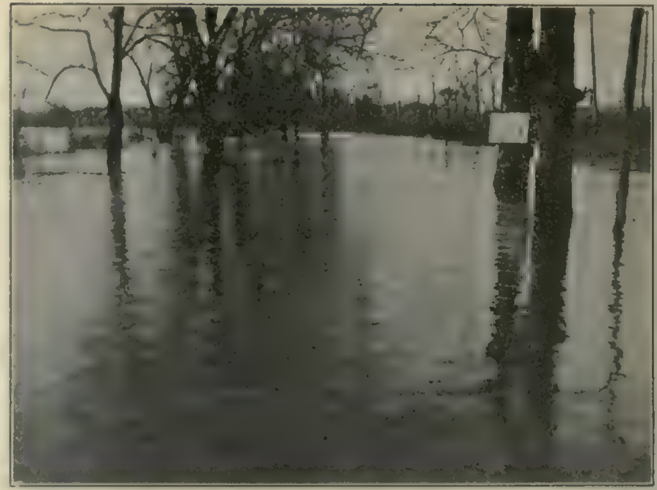
[†] President, Warren Brothers Company.

In this discussion "concrete" is considered as including any dense aggregate ranging from coarse to fine with the particles bound together by any cementing agent.

I assume it to be a pretty generally recognized fact that all forms of block pavement should be laid upon concrete foundations because broken stone does not provide a bed upon which the blocks will rest without danger of rocking under traffic. Incidentally, I believe that it will generally be conceded that unless the blocks are more thoroughly grouted than is practicable over the entire area a greater depth of foundation is required than for a monolithic wearing surface. In the case of a block pavement the weight transmitted to the foundation is that of the load on a single block, while in the case of a monolithic surface, the weight of the same load transmitted to the foundation is distributed over a many times greater area. We will, therefore, consider that the question of using a broken stone foundation is practically limited to cases in which a monolithic bituminous wearing surface is used.

LAYING WEARING SURFACE ON A BROKEN STONE FOUNDATION ON A SECTION OF THE COLUMBIA RIVER HIGHWAY IN MULTNOMAH COUNTY, OREGON.

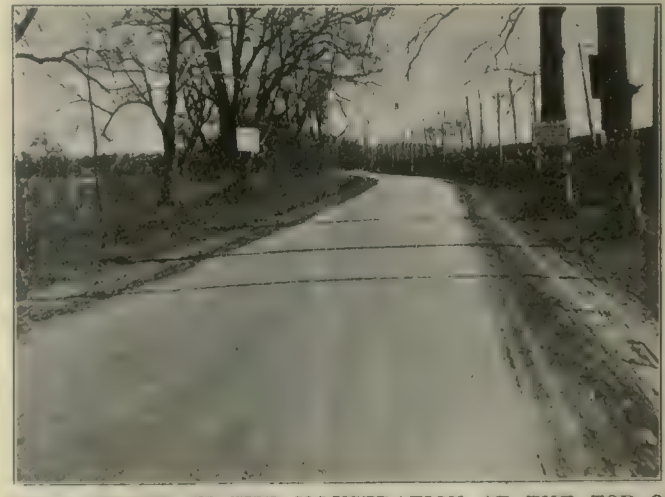
If the subsoil is of the nature of clay and the climate such that the sub-base is likely to become wet before the waterproof pavement surface is laid, it is unsafe to specify a broken stone foundation, because in such a case the subsoil does not provide a subgrade over which either the crushed stone or bituminous wearing surface can be properly compressed. If, on the other hand, the subsoil is of a gravelly nature, or if there is seldom or never rain during the working season, no more serviceable or inexpensive foundation than thoroughly rolled crushed stone can be provided for a stable bituminous wearing surface. This has been proven in many cases, as, for instance, in El Paso, Tex., where during the past 10 years nearly 600,000 sq. yd. of bitulithic pavement have been laid on broken stone foundations on a subsoil consisting, generally, of "caliche," a sort of clay-bonded gravel, and in Portland, Ore., where over 2,750,000 sq. yd. of the same kind of pavement have been laid during the past 12 years on a soil consisting usually of clay or loamy clay or occasionally of gravel. In both of these cities many of these pavements are on business streets carrying heavy traffic. In both cities comparatively dry weather prevails during the construction season so that the subgrade after once having been consolidated remains so until after the laying of the pavement. If the subsoil is of a gravelly nature and will allow water to drain through it with reasonable rapidity the factor of dry climate becomes of little importance in the matter of the pavement foundation to be laid.



SECTION OF THE HARTFORD-SAYBROOK TURNPIKE AT CROMWELL, CONN.—WARRENITE PAVEMENT ON A BROKEN STONE FOUNDATION UNDER 8 FT. OF WATER.

Nearly 16 years ago we had great difficulty in securing thoroughly compacted broken stone foundations on the sandy soil of one of the lake cities in Indiana. The spreading of marsh grass over the sandy subgrade before spreading the crushed stone helped immensely. During the present year we had an interesting experience in connection with the building of the bitulithic pavement on the approaches to the interstate bridge crossing the Columbia River and connecting Portland, Ore., with Vancouver, Wash. The approaches are about 3 mi. in length and are formed of sand pumped from the river, the fill varying in depth from 5 to 25 ft. Having been washed into place, the sand was compressed as solidly as possible. The paving specifications required the construction of a broken stone base on this fill. It is generally believed that under such conditions rolling the stone will drive it several inches into the dry sand and even then leave it not thoroughly compacted. It was proved that a generous amount of water used to wet the sand during the rolling and spreading of the base provided a subgrade so solid that the stone was forced into it but very slightly and also made it possible to similarly compact both the base and the wearing surface with a 12-ton roller.

Broken stone is utilized for pavement foundations very extensively by the shaping up of old macadam roads where their surfaces are sufficiently regular to make it possible to do this without seriously disturbing the old macadam.



ROAD SHOWN IN THE ILLUSTRATION AT THE TOP OF THE PAGE—AFTER BEING FLOODED ANNUALLY FOR FOUR YEARS IN SUCCESSION.

One especial advantage of the broken stone base under a bituminous wearing surface is that the pressure of the roller fills the chinks in the upper part of the foundation with the material of the wearing course, thus forming a bond between the two courses.

Concrete foundations may be divided into three general classes—those in which the binding material is Portland cement, those in which the binding material is bituminous cement, and those in which a binder of some other kind is used. In the discussion of foundations of this type we shall consider only those which are of true concrete—that is, a dense mass of coarse and fine aggregate with the coarse predominating and with the fines approximately sufficient in amount to fill the voids in the coarser aggregate. If the aggregate is not of this character the resulting material will be a mortar or will consist of a small proportion of coarse aggregate "floating" in a surplus of mortar and will not be an "economical and efficient" concrete. Where the subgrade is weak a solid dense concrete such as described has an important advantage in that it bridges over the weak sub-base and gives a greater strength to the pavement than can be secured with rolled crushed stone foundation. In the United States and Canada subsoil and climatic conditions are such that in a large proportion of cases the use of concrete is probably desirable. This, however, is not a universal rule. Well made Portland cement concrete of a 1:3:6 mix has a greater crushing and tensile strength than either broken stone or other types of concrete, but it is a well established fact that a slab of concrete laid on a more or less wet subsoil will crack; and where cracks occur in the foundation cracks in the wearing surface are sure to follow. In many cases this is the lesser of two evils and under such conditions there can be no doubt that Portland cement concrete is the best and, therefore, the most "economical and efficient" foundation.

Bituminous concrete with either gravel and sand or crushed stone and sand aggregate has the advantage of not cracking and also of providing the best bond between the foundation and wearing surface, the two courses being of the same class of material. The advantages of the bond between the two courses are first that it retards the tendency of the wearing surface to slip or shift under traffic and second that it permits the use of a somewhat thinner pavement than can be used with two courses of widely different characters.

The difference in the first cost of the completed pavement depends chiefly on the relative local cost of Portland cement and bituminous cement. At the present prices of Portland cement there are many sections where bituminous concrete foundations cost less than those of Portland cement concrete, and there are a few places where the difference in cost is in favor of the Portland cement concrete.

During the past five years bitulithic and Warrenite have been laid on bituminous concrete foundations with uniform success in various cities in the United States and Canada. Most of these pavements have consisted of a 3½-in. bituminous concrete base and a 1½-in. wearing surface. In some cases, however, an additional inch depth of base has been used.

During the past year the laboratory of the company with which I am associated has carried on extensive investigations in the use of silicate of soda as a cementing material for concrete foundations. These have shown that with a substantial waterproof bituminous wearing surface it is practicable to make high grade concrete foundations in this way. The question of using this material is one of the relative prices of Portland cement and silicate of soda. The silicate of soda concrete has greater resiliency and less rigidity than Portland cement concrete and apparently lessens, if it does not entirely overcome, the tendency to crack that is present in Portland cement concrete.

Highway Location[*]

By WM. A. OBENCHAIN[†]

Several generations ago in this country it was conceded that the location of highways was an engineering problem. European countries have conceded this for many years and their roads and systems of roads prove conclusively that the engineer is a necessity.

The roads built by the State of Kentucky about one hundred years ago prove also that engineering work is not just a matter of useless first cost, but an asset of cumulative value.

When the people of a country are called upon to vote a bond issue for good roads, the highway engineers might say to them what Robert Louis Stevenson said to the chiefs of Samoa when they had finished a road: "When a road is once built it is a strange thing how it collects traffic, how every year as it goes on, more and more people are found to walk thereon, and others are raised to repair and perpetuate it, and keep it alive; so that perhaps even this road of ours may, from generation to generation, continue to exist and be useful hundreds and hundreds of years after we are mingled with the dust. And it is my hope that our far-away descendants may remember and bless those who labored for them today."

To the public in general the surface has always been the most important feature. It is the only thing the layman sees. But the surface of a road is a liability and not in the strict sense of the word an asset. It must be maintained and renewed from time to time. It is an asset only in that it renders the permanent features of the road more serviceable.

The location of a road properly includes the right of way on which the road is built, and the grade lines which govern the excavation and embankment of the road. These are considered the permanent features of a road; but they are only permanent when properly and scientifically done. Drainage openings, if governed by the proper grade lines, and correctly designed and constructed of the proper material, may also be considered permanent.

Drainage and location are closely allied. The cry has been: "Drain, drain and drain some more!" The well drained road is not always the well located road, but the well located road is always well drained. So why not let the cry be: "Locate, locate and locate some more!"

The well located road can always be drained; it is always worthy of any surface or repairs put on it. It is an inspiration to permanent improvements which it can serve, and to communities which it will build up. These improvements will increase, and communities grow, and all because of the road which has been properly located and built. Just as the fine residence may sometimes need a new roof, so will the well located road need a surface; and just as gutters are needed for the residence, so is drainage for the road. But no man will put gutters and roof on a residence without a proper foundation and location. So why put drainage and surface on a road lacking the same features?

In this country the location of highways has long been a matter of political influence rather than scientific engineering. The people and officers of the people have often used their influence, not to locate a road where it should be located, but to locate that road for selfish motives and to cater to constituents—a policy which has caused a waste of funds sufficient to have built all the main roads in this country. The people demand efficiency, and yet won't allow it.

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[*] Extract from a paper of the same title presented at the meeting of the County Road Engineers' Association of Kentucky, Bowling Green, Ky., January 17-20, 1917.

[†] Division Engineer, Department of Public Roads of Kentucky.

The engineer making a location of a road today encounters many problems other than those of an engineering nature. When the political phase of road location does not enter into a project the old road does. Most of the old roads in Kentucky, and, in fact, nearly all states, have been laid out with an utter disregard of topographical conditions. In states laid off in sections they follow section lines. In Kentucky they do even worse—they follow the footpaths, and the metes and bounds of farms. This has been going on for a century, until most roads are nothing more than a strip of land running to suit every man's fancy.

These old roads cannot be drained except at foolish and enormous expense. Excessive grades can be reduced only by making high fills and heavy cuts. In fact, when they are improved they are monuments to an inconsistent and shortsighted age, that thought not of the future and only of present convenience.

Many counties have at times attempted to relocate roads. The most of this relocation was done by "viewers" appointed by the fiscal courts. These "viewers" were supposed to choose routes and report on them. They did so, and reported on and made locations of roads in an off-hand, casual way after riding over the land once. This same work would ordinarily take the conscientious engineer many weeks to report on and then only after hard work and cold-blooded comparisons.

Sometimes the court instead of employing an engineer, will intrust road building to the county surveyor, or to some friend who has invested himself with the title of "engineer." The county officials usually rush him and tell him where to make his location. He, not being an engineer, allows himself to be rushed and dictated to. Such a man does superficial work, a mere traversing of the old roads and meandering of property lines. Such work is naturally condemned. People say, and rightly too, that they could have done better without the engineer. Then people and officials unite in condemning all engineers as fakes.

When an experienced highway engineer is now called into a community to locate and build roads, he is confronted with the above problems and conditions. An eminent highway engineer once said: "No roads or road project of any magnitude can be completed or begun without a lawsuit." These obstacles thrown in the way of engineers cause more worry and work than the actual performance of his engineering duties.

The efficiency of an engineer is nowhere more plainly shown than in his dealings with fiscal courts and county officials. If he can win the confidence of these and make them further his work instead of hindering it, the battle is half won. Tact and diplomacy are as necessary to an engineer as a knowledge of trigonometry.

The engineer must not let right of way troubles influence in any way the work to be done. If you run a line so as to miss one man when conditions demand that you run through him, then you must run to suit every man through whose property the proposed road passes. This is a democracy, and all men have the same rights; but condemnation proceedings and not the indulgence of engineers or officials should decide the right of way.

Since most of the highway engineers at present are drawn from the railroads it might be well to point out one fact. Highway location and steam road location are fundamentally the same, but in practice radically different. The railroad engineer must realize this difference before he can successfully make a highway location. In general the alignment, grades, finances, and maintenance constitute the greatest variation in the two. Possibly the best way to see these differences is to ride over well located roads—and there are a great many—and study them.

Bill for Texas Highway Commission Introduced

A bill providing for the creation of a state highway commission was introduced at the present session of the Texas legislature on Jan. 9.

The bill, which was presented in the Senate by Claude Hudspeth of El Paso, and in the House by T. J. Wilson of Plainview, was drafted by a committee representing the Texas Good Roads Association which for some time has strongly advocated and led the movement for the improvement of highways in the state. An abstract of the measure introduced appeared in "Good Roads" for Dec. 30, 1916, page 253—"Proposed Texas Highway Legislation." Notice of the appointment of a committee to draft a bill establishing a state highway department and other references to the subject appeared in "Good Roads for Sept. 30 and Nov. 25, 1916, pages 142 and 215, respectively.

Educational Exhibit of the Pennsylvania State Highway Department

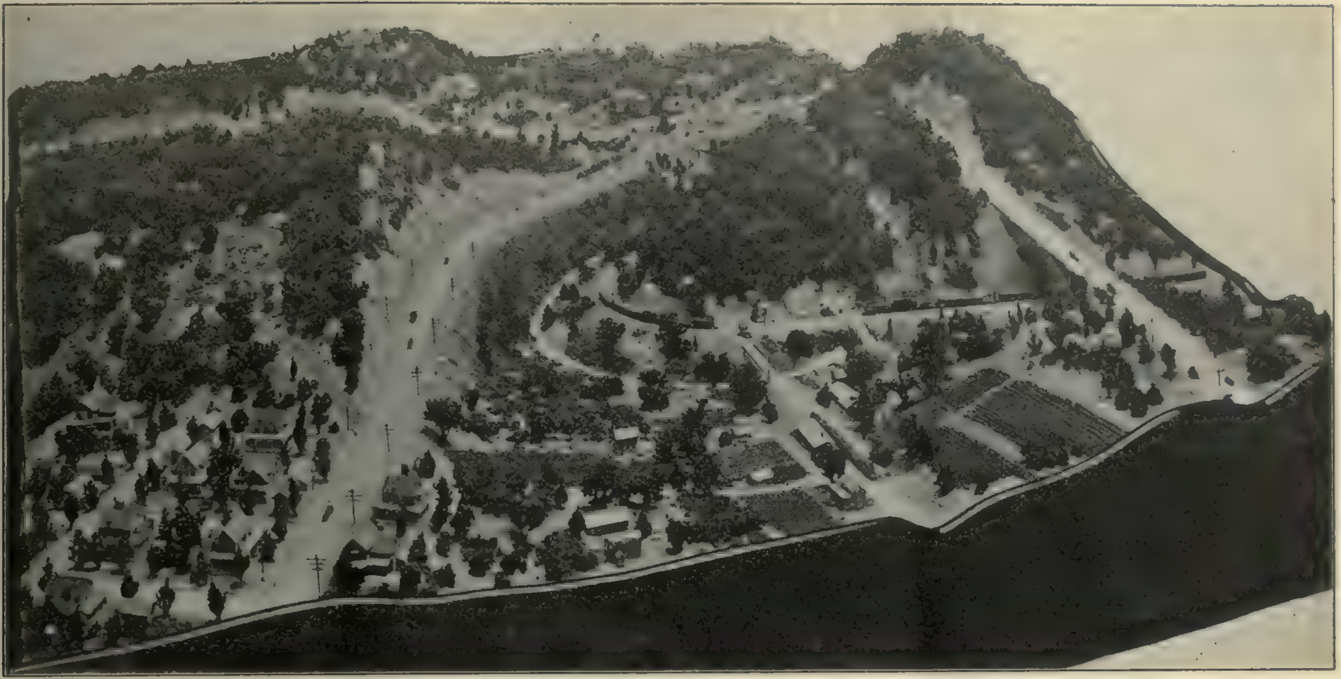
With the idea of showing the people exactly what the department was doing in the way of road construction and maintenance, the Pennsylvania State Highway Department last year prepared an educational exhibit, which was shown at a number of county fairs throughout the state during the summer and fall. The exhibit included models, photographs, charts, diagrams, plans, samples of road building materials, maps, and samples of the automobile license plates issued by the department each year from 1906 up to and including 1916, the former year being the first in which automobile plates were issued in Pennsylvania.

The exhibit was in charge of the Statistician of the Department, W. R. D. Hall, and was housed in a tent made especially for the purpose. At every fair where it was shown, the exhibit attracted great attention and large crowds daily filled the tent to examine the various articles and to hear the explanations given by those in charge at frequent intervals during the day. Many questions were asked and answered and every effort was made to fully inform all inquirers as to the work of the department in the past and its plans for the future.

The most interesting model was a topographical scene showing typical road relocations. This model, of which two views are presented in the accompanying illustrations, was constructed for the department at Howell's Microcosm, at Washington, D. C., and is one of the best road models ever built. Particular care was taken in the detail work with the result that the model has proved a compelling source of interest wherever exhibited.

In the illustration at the top of the page, two relocated roads are shown. In the background, to the right of the center, is seen a representation of a city. The main highway leading from the city across the center of the village at the left-corner, is a concrete road, built to replace an old one which can be seen winding back and forth up to the summit of the mountain and thence down the other side to reach the village and intersecting the new highway just at the border of the village. The relocated road is much shorter and the severe grades which characterized the old road, are eliminated in the new. The detail of construction is carried out faithfully, even to the standard wire cable guard rail lining the road.

The culverts placed at frequent intervals along the moun-



TOPOGRAPHIC MODEL OF ROAD RELOCATION EXHIBITED BY THE PENNSYLVANIA HIGHWAY DEPARTMENT

tainside and carried through beneath the road can be seen plainly in the illustration.

Another relocated road shown in the model is the one spanning the railroad and river, on a concrete viaduct at the extreme right of the illustration. This road, of asphaltic concrete construction, the viaduct being of reinforced concrete, replaces an old road, traces of which are seen coming over the side of a hill to the left of the new road. The old road came down the hillside to a dangerous grade crossing on the railroad, thence across the river on an old wooden bridge, and then wound up the hillside, as shown at the edge of the model. The relocated road shows the elimination of this dangerous and archaic condition and also gives the solution of vexatious grade problems.

The farm land detail, shown in the foreground of this illustration is faithful to an extreme degree.

The illustration at the foot of the page gives a view of the model taken from a different angle. The third relocated road and also the beginnings of the other two are shown. This road coming out of the city along the side of the creek, replaces an old highway which wound back and forth across the stream. Traces of the old road are seen, as is also one of the bridges now abandoned. The new road is a water bound macadam which has been surface treated, and the first steps in surface treatment are shown in the illustration. At the edge of the model, in the foreground, is seen the untreated water bound macadam road, and another section shows where bituminous treatment has been applied, the stone chips being placed in piles along the side of the road ready for use. The next section of the road shows the surface treatment in place. This stretch extends to the border of the city where it runs into an asphalt pavement.

The old road, behind the railroad depot, is a brick pave-

DIFFERENT VIEW OF MODEL SHOWN IN ILLUSTRATION AT TOP OF PAGE.

ment leading up to the new asphaltic concrete road which crosses the viaduct shown in the illustration. The old road may be seen coming up the hill behind the railroad depot and winding through the woods over the hillside. Directly in front of the depot is seen the start of the new concrete highway, the road which it replaces being the one which winds up the hill to the foreground of the photograph and thence back by means of a hairpin turn to the mountain.

Bituminous Surface Treatment Work in Warren County, New Jersey

By F. K. METZGER, C. E.*

During the past summer 22.049 mi. of old water bound macadam road, extending from Phillipsburg to Washington and from Phillipsburg to Belvidere, in Warren County, N. J., were resurfaced. These roads had been given two surface treatments during the past three years, but the increased motor vehicle traffic had caused them to ravel every spring, making smooth riding impossible.

The 1916 work consisted of resurfacing them with Ugite and asphalt, with a covering of screenings or approved gravel. Two different bituminous materials were used to test their relative values.

BITUMINOUS SURFACE TREATED ROADWAY ON A 6% GRADE IN WARREN COUNTY, N. J.

The Ugite was heated to a temperature of 250° F. and the asphalt to 350° F. and applied by a pressure distributor of the Finley patent, known by the trade name of "The Little Whirlwind Distributor." The method of application was as follows: The ruts and holes were first patched with Ugite and ¾-in. to 1½-in. stone several days before starting the resurfacing work. Traffic and the sun brought these patches to the original contour of the road. Just before resurfacing, the road was swept with a large revolving broom to remove all heavy foreign material. The lighter dust was blown off by means of air from a blower on the distributing machine. This was so arranged that the dust was blown ahead of the machine and that about one second after the dust was off the hot preparation was on the road. A gang of men followed the machine and covered the road immediately with dustless screenings and gravel from piles previously dumped along the road at intervals of about 20 ft. One-half of the road was done with one tank of preparation and then the other half was finished the same day.

BITUMINOUS SURFACE TREATMENT ON THE PHILLIPSBURG-BELVIDERE ROAD, WARREN COUNTY, N. J.

Each tank covered a distance of approximately 1,295 lin. ft., spreading to width of 8 ft. About ½ gal. of bituminous material and about 60 lb. of covering material were used on each square yard of road surface. Traffic was allowed upon the road about half an hour after the surfacing had been applied. With normal conditions prevailing we were able to resurface by this method approximately .8 mi. of 16-ft. road per day.

The work was done by Salmon Bros., of Netcong, N. J., and under the supervisor of the writer. The contractor's equipment included Garford 6-ton motor trucks, tank wagons, pressure distributor, etc. The work was done in approximately three months, allowing for delays due to shipments, rain, etc., amounting to about three weeks. The cost of the work to the county and the state was $2,132.36 per mile.

The Board of Estimate and Apportionment of New York City met recently and authorized the expenditure of $2,000,000 for repaving streets in all boroughs. It also authorized an appropriation of $200,000 for a bridge over the Bronx River at 174th St., $29,753 for wage increases in the Street Cleaning Department, and $393,500 for motor equipment for the ninth and eleventh districts and motor flushers and refuse collectors for Brooklyn and the Bronx.

PATCHING OLD ROAD BEFORE APPLYING SURFACE TREATMENT—WARREN COUNTY, N. J.

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*County Supervisor of Roads, Warren Co., N. J.

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Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

JANUARY 27, 1917

ROAD FOUNDATIONS

Grading, if properly done, is undoubtedly the most nearly "permanent" part of road work; it is, in fact, as nearly permanent as any work that goes into the building of an engineering structure. Next in point of permanence come the drainage structures and the foundation. These—again if properly built—for all practical purposes may be considered permanent portions of a finished road.

In a paper presented at the recent New York meeting of the American Association for the Advancement of Science, George C. Warren, President of the Warren Brothers Company, read a paper on foundations, in which he discussed at considerable length the relative values of broken stone and concrete foundations for various conditions. An abstract of the paper is printed elsewhere in this issue, and while the treatment of the subject may present nothing new it reiterates principles that although quite generally accepted in theory are too often neglected in practice.

To summarize in a few words the points made in the paper is to emphasize the necessity for building on each road the foundation which is best for that particular case. "Best" is a much misused word in the science and art of road building, and Mr. Warren took occasion to call attention to the non-existence of anything that is "best" under all conditions—a fact that has been emphasized many times before and probably will have to be emphasized many times more. There is, however, for any particular case a foundation that is best, using the word in its broadest sense. In other words in the case of any given road there is a foundation which will give the maximum service at the minimum cost.

It is a very easy matter to build a foundation that will be adequate to the demands upon it. It is equally easy to build a foundation that will fulfill every requirement of cheapness. But it is a very difficult matter to build a foundation that will do both. Nevertheless it is a problem that must be solved in road and street work, and it is for finding answers to such problems that the engineer is needed. Building a structure that is durable and that serves the purpose for which it is intended is not engineering unless the work is done economically. It is the business of the engineer to obtain for every dollar of the cost of his work a dollar's worth of service—and as much more as possible—and it should be one of the problems of the engineer to determine when cost is the factor which should count most in the selection of materials and methods of construction. Very often the service expected of a road calls for high priced materials and methods while conditions make the employment of those materials and methods impossible. Then the engineer must balance cost against serviceability and select something that is within the means of the community and that, at the same time, is capable of giving the maximum service for the money expended.

Both concrete and broken stone foundations have their places in road and street construction, and each under certain conditions is the logical foundation to select. Such selection, however, must be based upon the principles referred to and upon nothing else.

THE WORK OF THE SPECIAL ROAD MATERIALS COMMITTEE OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS

Considerable space is given in this issue to an account of the discussion upon the progress report made by the special committee on materials for road construction to the American Society of Civil Engineers at its last annual meeting. Besides the discussion there are noted certain portions of the report which brought forth the most discussion at the meeting.

Most readers of "Good Roads" are familiar with the history of the committee and its work. It has been collecting data and the views of road engineers for the past eight years, and, as stated in its last report, will present a final report at the next meeting. So far, it has confined its recommendations to general principles of construction without attempting to promulgate detailed specifications. It is presumed—and hoped—that this plan will be adhered to in the preparation of the final report, for it is believed that by so doing the committee will render a greater service to engineers than it will if it attempts to duplicate the work already undertaken by various organizations.

Through the annual meeting and other methods employed opportunity has been given to road builders to place their views before the committee and although the meeting of last week was the last opportunity of its kind for discussion on the committee's findings, it is understood that the committee is still open to suggestions from those who are sufficiently interested to make them.

Certain parts of the report met with strong objection from some of the engineers at the meeting. It was to be expected that the report would not meet the approval of every one and as the entire matter is subject to such revision as the committee may care to make with the criticisms of engineers before it, it would seem premature to take issue with the committee at this time and in this place. The personnel of the committee is such that a hearing is assured to anyone who has criticisms to offer, and a fair and careful consideration of such points as are brought to its attention can be expected. It will be a year before the final report is rendered and in the meantime those who object to any of the recommendations should bring the matter to the attention of the committee.

Grant Parish, Louisiana, will hold an election on March 13, 1917, for the purpose of deciding upon a bond issue of $150,000 proposed for the improvement of roads in District No. 8. This election was set for an earlier date, but postponed in order to permit all voters to register under the new registration law.

Progress Report of the Am. Soc. C. E. Special Road Committee, and Discussion Upon It

A meeting for the discussion of the progress report of the American Society of Civil Engineers' Special Committee on Materials for Road Construction and on Standards for Their Test and Use, was held at the society's house at New York, N. Y., on Friday, Jan. 19. The meeting followed the regular annual meeting of the society and was attended by a large number of members and others interested in the subjects under discussion. Two sessions were held, one in the forenoon and one in the afternoon. Geo. W. Tillson, Consulting Engineer of the Borough of Brooklyn, presided in the place of Maj. W. W. Crosby, the chairman of the committee, who is absent on duty with the army on the Mexican border.

The committee was appointed by the American Society of Civil Engineers in May, 1909, as the "Special Committee on Bituminous Materials for Road Construction and on Standards for their Test and Use." The members were: Maj. W. W. Crosby, Chairman, Arthur H. Blanchard, Secretary; H. K. Bishop and A. W. Dean. In 1914 the word "bituminous" was stricken from the title, thus broadening the scope of the committee's activity. At the same time Nelson P. Lewis, C. J. Tilden and Geo. W. Tillson were added to the committee. Yearly progress reports have been made by the committee and have been discussed at special metings held at the close of the annual meetings of the society. General invitations to all interested, whether members of the society or not have been extended and the discussion brought out has been used by the committee in its work. In the progress report for this year it is stated that during the coming year the committee intends to prepare a final report based on its 1915, 1916 and 1917 progress reports and the discussions at the meetings of the past three years.

The 1917 progress report is a document of considerable length covering, first, various general considerations and, second, each of the several types of roads and pavements in common use. At the meeting of last Friday the report was taken up by topics, and in the following paragraphs are contained resumes of the more important parts of the report and brief accounts of the discussion upon them.

The first part of the report deals with "general principles concerning materials and their use to be observed in framing specifications for pavements and road crusts." These, according to the committee, may seem of common knowledge but are included in the report because of the frequent neglect to carry on work in accordance with them.

Besides the discussion from the floor a number of written discussions had been sent to the committee. These were read by Secretary Blanchard during the meeting, the part referring to each subject being read during the discussion on that subject. Among those who sent in written discussions were Clifford Richardson, of the Barber Asphalt Paving Co., Col. E. A. Stevens, State Commissioner of Public Roads of New Jersey, Edward Whitmell, President of the Institute of Municipal Engineers, Great Britain, and C. Hyatt of the Atlantic Asphalt Block Co.

Lines and Grades.—Under this head the committee's report makes recommendations for maximum grades as shown in Table I.

Considerable discussion was developed on this point. Col. Stevens expressed the belief that gravel and broken stone should not be used on grades as great as 12% on account of the scour from surface water. Clifford Richardson disagreed with the committee's recommendation for the 5% maximum grade for sheet asphalt, stating that the material was not itself slippery and had been used successfully on grades up to 7 or 8% and in exceptional cases on grades as great as 12%, in one case in Pittsburgh a grade of 17% existing on a short section of street.

Width.—According to the committee's report, width should be determined largerly by local conditions. It is recommended that where motor traffic forms a considerable part of the total the unit width of traffic lines should be 9 or 10 ft. instead of 7 or 8 ft. In the discussion by Commissioner Stevens attention was called to the need of extra width at curves. Most of the discussion on this subject, as was the case with many of the other general topics, was deferred until the various kinds of pavements were taken up by the meeting.

TABLE I—RECOMMENDED MAXIMUM GRADES.

Kind of Roadway	Maximum Grade Per Cent.
Gravel	12.0
Broken stone	12.0
Bituminous surface	6.0
Bituminous macadam	8.0
Bituminous concrete	8.0
Sheet asphalt	5.0
Cement concrete	8.0
Brick (cement grout filler)	6.0
Brick (bituminous filler)	12.0
Stone block (cement grout filler)	9.0
Stone block (bituminous filler)	15.0
Wood block	4.0

Thickness.—The committee's recommendations in regard to thickness are shown in Table II.

TABLE II—RECOMMENDED PAVEMENT THICKNESSES.

Kind of roadway	Thickness of artificial foundation*, in inches	Thickness of sand cushion or binder course in inches	Thickness of wearing course in inches
Gravel	4 to 8	....	2 to 4
Broken stone	3 to 8	....	2 to 3
Bituminous surface	4 to 8	....	¼ to ⅓
Bituminous macadam	3 to 8	....	2 to 3
Bituminous concrete	3 to 8	....	1½ to 3
Sheet asphalt	5 to 8	1 to 1½	1½ to 2
Cement concrete (1 course)	....	....	5 to 8
Cement concrete (2 course)	4 to 8	....	2
Brick	4 to 8	¾ to 1½	3 to 4
Stone block	5 to 12	1 to 2	2½ to 5
Wood block	5 to 8	½	3½ to 4

*Not including extraordinary provisions such as V-drains or sub-base course.

In the discussion of this topic, C. D. Pollock, Consulting Engineer of the Granite Paving Block Manufacturers' Association, questioned the propriety of using over 8 in. of concrete for granite block pavement. Mr. Beeler stated that in western cities a 3-in. wood block had been used quite successfully and that even a 2½-in. block had been employed when laid directly on the concrete foundation. He recommended that the minimum thickness of 3½ in., recommended by the committee for wood block should be reduced to 3 in.

Drainage; Artificial Foundations; Subgrade.—There was very little discussion on these three topics, most of the comment made on them being brought up under the conderation of the different kinds of pavements.

Materials.—Among the recommendations of the committee under this head is the following:

> Whenever comprehensive specifications are to be prepared so as to admit a variety of types of bituminous materials, separate specifications, as may be necessary, should be prepared for each type.

There was considerable discussion upon this point. Mr. Richardson held, with the committee, that separate specifications should be prepared. This view was also held by G. P. Hemstreet, Superintendent of the Hastings Pavement Co., and others. E. W. Stern stated that he believed the preparation of separate specifications to be the wrong method. The same position was taken by Prof. C. E. Mickey, of the University of Nebraska, and by A. B. Fulweiler, of the United Gas Improvement Co. Mr. Fulweiler stated that because of the ignorance of bituminous materials on the part of engineers, many so-called specifications were not specifications but merely descriptions in technical language of certain specific products.

Joints.—Both bituminous and cement mortar fillers are included in the committee's recommendations, and it is also stated that sand alone should never be used as a joint filler. Attention is called to the necessity for care in mixing and applying cement grout and the necessity for allowing ample time for the grout to set before admitting traffic to the pavement.

In regard to bituminous fillers the following recommendations are made:

> **A bituminous filler may be preferred to a cement grout filler, on account of the lower cost of street opening repairs, the better foothold provided for horses, and the securing of a more resilient, and hence less noisy pavement. On steep grades, where some roughness of surface may be desirable for the sake of affording better foothold for animals, some openness at the top of the joint is desirable, and the bituminous joint fillers may be preferred. With bituminous joint fillers, care must be taken to select materials which will not be too brittle in cold weather and so chip out from joints under traffic, and which will not be so soft in hot weather as to flow out of the joints between the blocks. It is believed, although not yet generally admitted as having been actually proven by experience, that the use of a bituminous mastic for joint filling would be an improvement over the customary practice of using bituminous material alone for this purpose. Great care should be taken with bituminous fillers of any kind to insure the actual filling of the joints between the blocks, and great care must be taken to insure this result.**

Considerable discussion was brought out on this point, but most of it was deferred until later when block pavements were under discussion.

Expansion-Contraction Joints.—Under this head the committee cites the use of transverse joints in brick and cement concrete pavements and recommends that where used they be filled with bituminous material, and that all forms of "armored" joint be abandoned.

Shoulders and Gutters; Finishing of Surface.—There was no discussion of either of these topics.

Gravel Roads.—Among the recommendations of the committee in regard to gravel road construction are the following:

> **With gravel such as quartz, the cementation of which is low, a highly cementitious void filler is desirable, and a moderate quantity of clay or loam may be permissible.**

This recommendation was the basis for much of the discussion on this type of road. In a written discussion by Henry Goldsmith, which was read by Secretary Blanchard, reference was made to the construction of gravel roads in the Philippine Islands. The material used in this case was mostly quartz of low cementing value, and it was found necessary to use about 20% of clay filler. Prof. Mickey stated that he agreed with Mr. Goldsmith and suggested that the committee's recommendation be changed to call for a clay or loam of "high cementing value."

Col. Stevens stated that specifications based on mechanical analyses were not satisfactory. He said that gravels differed widely and that specifications should never call for materials from a particular deposit.

Broken Stone Roads.—Most of the discussion on this topic was upon the recommendations for the foundation and the character of material in the roadway. The committee's recommendations relative to foundations are as follows:

> **Artificial foundations of cement-concrete are not advisable or economical for this type of road. The most preferable foundations consist of broken stone (either field or ledge), gravel, clean, coarse sand, or cinders.**

H. S. Mattimore, in charge of the physical testing of materials, New York State Highway Department, said that he did not believe "clean, coarse sand" was suitable, as it was not stable. He also said that in the bottom course it was customary to use any available material that would stand rolling.

In regard to the material the committee recommends that "All broken stone should be clean, rough-surfaced, sharp-angled, of compact texture, and uniform grain." Clifford Richardson said that the expression "sharp-angled" should not be used, as what was really wanted was "obtuse-angled" stone.

Another paragraph in the report recommends that: "On an 8-in. road, sizes properly used are as follows: Bottom or first course, 2¼ to 3½ in.; 3½ in. thick. Second course, 1¼ to 2¼ in.; 2½ in. thick. Third course, ⅝ to 1¼ in.; 2 in. thick." Wm. H. Connell, Chief of the Bureau of Highways and Street Cleaning, Philadelphia, called attention to the successful use of 2½-in. stone in the top course.

Broken Stone Roads with Bituminous Surfaces.—The recommendation under this head which brought forth the most discussion follows:

> **After the bituminous material is applied it should be covered immediately with the toughest grit obtainable that will pass through a screen with openings not less than ⅜ in. nor greater than ⅝ in., just enough of such material being used to cover the bituminous material. It is advantageous, but not entirely necessary, to roll with a steam roller after the application of the grit.**

A. B. Fulweiler said that the treated surface should not be covered immediately, as the object of the treatment was to get the bituminous material into the road. The covering, he said, prevented this by drawing up the material.

Mr. Sharples stated that applying the bituminous material too soon would tend to distintegrate the road, especially if there was a lack of fine material in the road. He also said that the road should be carefully filled.

Herbert Spencer, of the Standard Oil Co., objected to the committee's statement that: "It has been demonstrated that bituminous material of such consistency that it can be applied at a temperature below 52° C. (125° F.) is preferable to heavier material, and that the application of a quantity in excess of ½ gal. per sq. yd. is inadvisable." He said that fixing the temperature at 125° F. would prevent the use of heavy materials such as had been employed successfully in much work already done.

Bituminous Macadam Pavements.—Clifford Richardson objected to the committee's statement that "thorough rolling" both before and after the application of bituminous materials was necessary. He said that it was not always well to roll before applying the material and that when natural asphalts were used the road should not be rolled until after the material was applied. Theron M. Ripley, Division Engineer, New York State Highway Department, said that it was possible to roll a road altogether too much, and suggested that the words "thorough rolling" in the report be omitted or modified.

Most of the discussion on bituminous macadam pavements was upon the amount of binder to be used. The committee's recommendation on this point is as follows:

> **The quantity of bituminous material used should be just sufficient to penetrate through the upper course and fill the voids; such penetration and filling is accomplished by the application of approximately 1 gal. of bitumious material to the square yard per inch in thickness of the upper course.**

A. B. Fulweiler said that the committee had suggested an excessive amount of bituminous material and that ½ gal. per sq. yd. for each inch in depth of loose stone had been shown by experience to be about the right quantity. Mr. Sharples said that 1 gal. per sq. yd. per in. depth of finished surface was about the right amount if the seal coat were included in it. J. A. Johnston, Engineer of the Massachusetts

Highway Commission, was also of the opinion that it was seldom advisable to use less than 1 gal. per sq. yd. per inch depth.

Bituminous Concrete Pavements.—The report of the committee divides concrete pavements into three classes as follows:

> (A) A bituminous concrete pavement having a mineral aggregate composed of one product of a crushing plant;
>
> (B) A bituminous concrete pavement having a mineral aggregate composed of a certain number of parts by weight or volume of one product of a crushing plant and a certain number of parts by weight or volume of fine mineral matter, such as sand or stone screenings;
>
> (C) A bituminous concrete pavement having a predetermined mechanically graded aggregate of broken stone or gravel, either alone or combined with fine mineral matter, such as sand or broken stone screenings.

In discussing class B pavements the committee's report makes the following statement:

> Specifications for pavements of this class have generally stipulated that so many parts of broken stone or gravel and so many parts of sand or other fine material are to be mixed with a certain quantity of bituminous cement. By the use of this specification, unless under unusual supervision, it is not practicable to secure a well-graded aggregate. Although in many cases the mixture contains an excess of broken stone with insufficient fine material to fill the voids therein, in other cases it contains an excess of sand in which the broken stone is contained as isolated particles. In general, because of the conditions described, either bituminous concrete pavements of Class A or Class C should be used.

Mr. Connell objected to this, stating that most bituminous concrete work was properly included under Class B, the usual aggregate consisting of about ⅔ of one product of a crusher and about 1/3 fine material.

A. B. Fulweiler objected to the portion of the report dealing with bituminous cements. This is as follows:

> Experience has demonstrated that the most efficacious bituminous concrete pavements of Class A are constructed by using suitable asphalt cements or refined tars in the mix and asphalt cements for seal coats.

In discussing this point Mr. Connell stated that while an asphalt seal coat would last longer than a tar seal coat the latter could be used successfully if the seal coat were renewed frequently. He said that because of the lower cost of the tar this would prove as economical in the end as using asphalt.

Asphalt Block Pavements.—Asphalt block pavements were included in the report under the general head of bituminous concrete pavements. Geo. B. Hemstreet described at some length the method of manufacturing asphalt blocks. In the course of his remarks he called attention to the necessity for having clean aggregate and said that the use of Portland cement as mineral dust was expensive and that limestone dust had been found the best material for this purpose.

Sheet Asphalt Pavements.—The principal discussion on sheet asphalt pavements dealt with the thickness of the wearing course and the binder course, and with the necessity and functions of the latter. The committee's recommendations as to thickness are as follows:

> A sheet asphalt wearing course, consisting of predetermined graded sand, filler and asphalt cement, should be laid to a compacted thickness of not less than 1½ in. and not more than 2 in., on a binder course of bituminous concrete consisting of broken stone or broken stone and sand mixed with asphalt cement, the binder course having a compacted thickness of not less than 1 in. nor more than 1½ in.

Clifford Richardson expressed the belief that a greater thickness than 2 in. was often desirable, and later said that he agreed with Mr. Goldsmith, in whose written discussion a 2-in. binder and 1-in. wearing surface were recommended. Mr. Richardson also disagreed with the committee's recommendation that: "In cases where sheet-asphalt is constructed next to the curb, it is advisable to coat the surface for a space of 12 in. next to the curb with hot asphalt cement."

E. W. Stern stated that while the binder course had generally been looked upon as a necessity he would ask if it could not be omitted. Mr. Richardson replied that its omission would be apt to result in the displacement of the surfacing, but that it was not absolutely necessary if the stability of the top course could be assured without it. Col. J. W. Howard stated that no European city used a binder course. He advocated, however, the use of a dense binder to waterproof the pavement, even up the foundation, and bind the wearing surface to the foundation.

Cement Concrete Pavements.—The general recommendations of the committee in regard to cement concrete pavements are as follows:

> A thickness of from 5 to 8 in., as stated in the general principles, may ordinarily be considered sufficient for a concrete slab, and if it seems advisable, from motives of economy, the thickness may be diminished from the center of the slab to the edges. Special conditions may call for variations, even outside of the limits given. The character and drainage of the subgrade, its probable stability as a foundation, as well as the nature and amount of traffic, are some of the factors which enter into the rational determinations of the thickness of the slab.

The committee also recommends that the coarse aggregate used, in general, should not be larger than that which will pass a screen with 1½-in. circular openings. The report also states that: "In proportioning the ingredients of the concrete a mixture based on mechanical analyses is in general to be preferred to the arbitrary rule of a 1:2:4 or 1:3:5 mix."

Mr. Richardson suggested that a concrete pavement should be considered as an arch and made thicker at the sides than at the center, holding that a pavement was really a bridge over the subsoil. A. N. Johnson, of the Portland Cement Association, said that he did not see how this method could result in arch action and suggested that if concrete pavement be built in this way the same rule should apply to the concrete foundations of other pavements. He also said that a concrete pavement should not be less than 6 in. thick and that in the future it would probably be built thicker than that rather than thinner.

W. M. Kinney, of the Universal Portland Cement Co. expressed the belief that the coarse aggregate should be larger than that recommended by the committee, and suggested that until we had more knowledge of concrete, the arbitrary rules of proportioning would give better results than the methods suggested by the committee.

Samuel Whinery stated that the use of bituminous surfacing on concrete pavements gave satisfaction, and stated that he believed that the coming concrete pavement would be a bitumnous carpeted concrete pavement. He also suggested the use of the two-course method of construction and commended the tendency to get away from the arbitrary proportions for mixing.

Brick and Slag Block Pavements.—That portion of the committee's report dealing with grades and their relation to joint fillers is as follows:

> The maximum grade of 6% heretofore given is intended to apply to pavements with cement mortar joints; where bituminous joints are used, or where the brick or blocks are specially designed to prevent slipping, grades as high as 12% may be used. With special "hillside" brick, bituminous joints should always be used.

The report recommends a sand cushion, 1 in. or less in depth, between the foundation and the wearing surface, and merely mentions the use of the monolithic method of construction. It is stated, however, that there may be substituted for the sand cushion or for cement mortar a cushion course "composed of sand or stone chips and a bituminous cement from ¼ to ½ in. in thickness," this to be used provided the concrete foundation is sufficiently smooth.

Most of the discussion on this portion of the report was contained in a paper read by Will P. Blair, Secretary of the

National Paving Brick Manufacturers' Association. Among the points made by Mr. Blair were that the maximum grade specified by the committee was too low. He suggested the use of the cement grouted brick pavement for grades up to 6% and grouted hillside brick for grades of 6% and up. He also favored the use of grout filler instead of bituminous filler and recommended the monolithic method of construction.

Stone Block Pavements.—Most of the discussion on stone block pavements referred to the committee's recommendation that granite for paving blocks should have a crushing strength of not less than 20,000 lbs. per sq. in. C. D. Pollock and H. W. Durham, formerly Chief Engineer of Highways of the Borough of Manhattan, New York City, Wm. H. Connell, and others argued against the inclusion of this test.

Wood Block Pavements.—The specifications submitted by the committee for the preservative material for wood blocks were the subjects of most of the discussion on wood block pavement. The report contains three specifications—one for distillate oil, one for coal tar paving oil, and one for water gas tar oil. Mr. Fulweiler objected to the presentation of these detailed specifications, holding that it was contrary to the usual practice of the committee of laying down only broad principles. Chairman Tillson explained that the specifications were submitted because they were those which had been agreed upon by representatives of a number of organizations. He stated that the same specifications had been adopted by the American Society of Municipal Improvements, and that very similar specifications would probably be adopted by the American Wood-Preservers' Association at its meeting on January 25.

Col. Howard objected to the inclusion of the float test in the specifications, stating that it was not used. He also said that plant inspection should be specified "when possible," as buyers of small lots were not in position to have such inspection made. S. R. Church, Manager of the Research Department of the Barrett Co., favored the inclusion of the float test, but stated that he believed the penetration test to be better.

Motor Traffic and Its Effect on New York Roads

The growth of motor traffic in New York State and its effect, especially in conjunction with the spring break-up, were described by First Deputy Commissioner H. Eltinge Breed of the New York State Highway Department at the annual meeting of the American Association of State Highway Officials held recently at St. Louis, Mo. A resume of Commissioner Breed's remarks follows:

When New York State commenced road work in 1898 the roads were designed for horse-drawn farm traffic with loads of from one to three tons. The type usually built was a water bound macadam road from 6 to 8 in. in thickness. Such roads provided sufficient bearing power for all loads to which they were subjected at that time, and the fact that many of them are being used today for loads of from 16 to 20 tons accounts for their rapid disintegration and their high cost of maintenance.

The roads first began to fail with the advent of the motor car in about 1902. Even then, however, the thickness was considered ample, and the chief problem was believed to be the prevention of the crust from raveling. Three or four years later bituminous binders began to be used to abate the dust nuisance and to form a bituminous mat or surface that would not disintegrate.

As the motor vehicle became a more reliable method of transportation, the loads carried became greater, adding the effect of weight to the effect of speed.

The increase of motor and other traffic on the improved highways of New York is shown by the traffic counts taken by the Department of Highways in 1909, 1914 and 1916. From 1909 to 1914 there was an increase of 216% in the number of motor vehicles and a decrease of 11½% in the number of horse-drawn vehicles. From 1914 to 1916 there was an increase of 66% in motor-driven vehicles and of 12% in the number of horse-drawn vehicles. These figures were taken from an average of eleven roads in representative sections of the state outside the limits of large cities. From additional reports, it was learned that the traffic upon improved state and county highways for motor trucks amounts to 14,734,680 mi. and 60,216,520 ton-miles during 40 weeks of the year, the 12 weeks during the winter season being eliminated.

During the past year the heavy wheel loads of the motor trucks and motor busses did much damage to the roads in the state at about the time of the spring thaw when there was water in the ground and the subsoil under the pavements was wet and in a more or less unstable condition. A survey made to determine the cause of the break-ups showed the following.

Out of a total of 1,879 roads having a pavement area of 44,400,000 sq. yd. and a total length of 4,733 mi. there were 358 roads affected by break-ups. In these 358 roads there were 14,138,000 sq. yd. of pavement of which 758,000 sq. yd., or 5.4% of the total, were broken up. This was a much larger percentage than in any previous year. Of the 758,000 sq. yd. broken up 18% was attributable to heavy and general traffic, 3.4% to motor trucks, 3.3% to motor busses, 50% to poor drainage, 25% to unstable subgrade, 11% to too thin pavement, and 16% to poor bottom course. The sum of these percentages equals 127, because some of the break-ups were attributable to more than one cause.

This showing is not such a reproach to the road conditions of the state as might appear at first glance, as 460,000 sq. yd. of the total broken up consisted of roads built prior to 1910, all of which were of water bound macadam of an average thickness of only 6 in.

The large percentage due to poor drainage can probably be accounted for by the fact that the roads were all the way from 7 to 16 years old, and it is reasonable to suppose that many of the drains had become clogged. While percentages due to heavy general traffic, trucks and motor busses—18%, 3.4% and 3.3% respectively—do not seem proportionately large, it is a fact that many of the breaks commonly attributable to poor drains and thin pavement, which comprise a total of 61%, would not have occurred had the road not been subjected to the motor truck and motor bus traffic.

In conclusion Commissioner Breed pointed out that traffic will continue to increase and that the destructive agencies will remain, and that the problem before road builders is to build roads capable of sustaining the present loads with a factor of safety large enough to take care of present traffic. He pointed out that it has been suggested that this problem be taken care of by legislation restricting the size of the load in accordance with the width of the tire, and stated that he believed that legislation should control conditions so that unreasonable traffic would be prevented from destroying the benefit taxpayers ought to receive from road improvement.

Presentation to the Colorado Legislature of a bill to provide for a bond issue of $25,000,000, by the Denver Motor Club, is among the efforts being made to secure the permanent improvemeint of roads in that state.

The Road Between Granite Mountain and Redding Springs, Utah, may be improved as a part of the Lincoln Highway. The distance is about 20 mi. and it is stated that a private donation of $300,000 would be made for constructing the highway.

Appropriations for Road Work in Alaska amounting to $800,000 have been asked by Col. W. P. Richardson, U. S. A., president of the Board of Road Commissioners for Alaska, $300,000 of which is for use in building a bridge to connect Juneau with Douglas Island.

Resurfacing Worn-Out Macadam With Brick in Lee County, Illinois

By L. B. NEIGHBOUR*

Dixon Township in Lee County, Illinois, recently voted a bond issue of $82,500 to meet the cost of resurfacing its most heavily traveled worn-out macadam roads with brick.

Franklin Grove Road, a portion of the Lincoln Highway east from Dixon, the Palmyra Road, a portion of the Lincoln Highway west from Dixon, and the Colony Road, are the three highways chosen to receive improvement under this bond issue. In all, 4.05 mi. are included in the contracts which are now being prosecuted. Of the total, 1.75 mi., 17 ft., 3 in. in width, is on the Franklin Grove Road. The Palmyra Road is being improved with brick for a distance of 1.3 mi., 17.3 ft. wide. Colony Road will be paved with brick for a length of a little over 1 mi., having a 10-ft. brick roadway on either side of the highway, and between the bricked portion a strip, 10-ft. in width, with a car track which will be brought to grade with crushed stone.

The contract prices for the work are respectively, $28,300, $25,000 and $28,000.

Each of these roads is an important one to Dixon, and when completed will provide easy access to the town from much of the surrounding territory and thus serve both the farmers and the city merchants. The Colony Road leads to the Country Club House and to Dixon's splendid 200-acre Lowell Park. The Franklin Grove and the Palmyra Roads, being the Lincoln Highway through Dixon, will carry transcontinental traffic when completed.

The specifications for the brick pavement on all three jobs were substantially the same. The old road in each case was worn-out macadam. Sufficient stone was added to make a foundation 6 in. deep after rolling. Upon the stone base the brick were laid on a 2-in. sand cushion and grouted with cement grout. The old macadam was used intact except where conditions required the addition of fresh stone in order to give the full depth of 6 in. to the base.

The brick are retained on Palmyra Road by a concrete edging 5 x 12 in., on Colony Road, by a combined concrete curb and gutter on the outside of each paved stretch and a 6 x 11-in. curb next to the car track.

The Franklin Grove section is now completed with the exception of 1,300 ft. Colony Road is practically half completed at this writing, and grading is now in progress on the Palmyra division which will soon be ready for paving operations.

CEMENT GROUTED BRICK PAVEMENT LAID ON A SAND CUSHION ON AN OLD WATER BOUND MACADAM ROAD AS FOUNDATION—DIXON, LEE COUNTY, ILLINOIS.

F. W. Fisher, T. F. Rosbrook, W. H. Lennox, Highway Commissioners, are in charge of the expenditure on these roads. Work on the Lincoln Highway divisions is in charge of Engineer H. T. Shaw. The writer, as County Superintendent of Highways, has general direction of all the work.

Messrs. Duffy and Hubbard are the contractors on the Palmyra Road and Colony Road jobs, and Messrs. Rink and Schnell were awarded the contract for the improvement of Franklin Grove Road.

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*County Road Superintendent, Lee County, Ill.

The Ocean Road from Venice to Redondo Beach, Cal., will be completed by the construction of a 3-mi. section between Playa del Rey and Manhattan Beach, costing about $20,000.

Taxpayers of Bainbridge Township, Berrien County, Mich., propose a bond issue of $1,000,000 for improving the highways of the county, and have voted for a special election on a bond issue of $70,000 for use in the township.

Ellsworth County, Kansas, will build a concrete bridge across the Smoky Hill River this year, according to recent advices. The bridge is to be 317 ft. long, four span, with a 20-ft. roadway and 5-ft. sidewalk on each side.

BRICK PAVING ON OLD MACADAM FOUNDATION—COLONY ROAD, LEE COUNTY, ILLINOIS—PAVED STRIP ON ONE SIDE OF TRACKS COMPLETED.

COLONY ROAD, LEE COUNTY, ILLINOIS—SHOWING BRICK PAVEMENT BEFORE GROUTING AND UNFINISHED BROKEN STONE PAVING IN RAILROAD AREA.

MEETINGS

Calendar of Coming Meetings

Jan. 31-Feb. 2—Ohio Engineering Society—Annual meeting, Ohio State University, Columbus, O. Secretary, John Laylin, Norwalk, O.

February 5-9.—American Road Builders' Association— Fourteenth Annual Convention; Seventh American Good Roads Congress under the auspices of the A. R. B. A., and Eighth National Good Roads Show of Machinery and Materials. Mechanics' Hall, Boston, Mass. Secretary, E. L. Powers, 150 Nassau Street, New York, N. Y.

February 7-15.—Tenth Chicago Cement Show—Coliseum, Chicago, Ill. Secretary, Blaine S. Smith, 210 South La Salle street, Chicago, Ill.

February 8-10.—American Concrete Institute—Annual meeting, Hotel LaSalle, Chicago, Ill. Secretary, Harold D. Hynes, 1418 Walnut Street, Philadelphia, Pa.

Feb. 9.—Texas Town and City Planning Association.— Semi-annual convention, Sherman, Tex. Secretary, J. E. Suratt, Sherman, Tex.

February 13-14—Pikes Peak Ocean to Ocean Highway Association—National annual convention, St. Joseph Mo. Secretary, A. W. Henderson, Colorado Springs, Colo.

February 17-20.—U. S. Good Roads Association.—Fifth annual convention, Birmingham, Ala. Secretary, J. A. Rountree, 1021 Brown Marx Building, Birmingham, Ala

February 19-24.—Southwestern Concrete Association—Annual meeting and show, Kansas City, Mo. Chairman of committee, Charles A. Stevenson, 1433 West 10th St., Kansas City, Mo.

March 5-6—National Paving Brick Manufacturers' Association—Annual convention, Hotel McAlpin, New York, N. Y. Secretary, Will P. Blair, Cleveland, Ohio.

March 5-7—American Ceramic Society—Annual meeting, Hotel Astor, New York, N. Y. Secretary, Edward Orton, Columbus, O.

Virginia Road Builders' Association

The sixth annual convention of the Virginia Road Builders' Association was held at Norfolk, Va., on Tuesday, Wednesday and Thursday of last week. The opening session on Tuesday, Jan. 16, was held at the Monticello Hotel, President Otto L. Evans of the Association presiding. Mayor Mayo of Norfolk delivered an address of welcome and was followed by W. S. Fallis, Chief Engineer of the North Carolina Highway Commission, who spoke on "Highway Construction in North Carolina." H. W. Anderson, President of the Richmond-Washington Highway Association, who was expected to speak, was unable to attend. In the afternoon the delegates made a tour of the Norfolk Navy Yard, paying a visit to the battleship "Arkansas."

The actual work of the convention began on Wednesday, Jan. 17. The principal speaker during the morning was J. D. Eggleston, President of the Virginia Polytechnic Institute, the subject of his address being "The Relation of the Public Schools to Road Improvement." Other speakers of the morning were W. F. Childs, Resident Engineer of the Maryland Highway Commission, who talked on concrete road construction in Maryland, and W. B. Deneen, Resident Engineer of the Virginia State Highway Commission, on "Sand-Clay and Top Soil Construction." The program for Wednesday included the appointment of committees. In the afternoon an inspection trip over the new concrete roads of Norfolk County was made in automobiles furnished by the Tidewater Automobile Association. In the evening the delegates attended a performance at the Colonial theater as guests of the automobile association.

On Thursday morning, Jan. 18, Geo. P. Coleman, State Highway Commissioner, spoke on "The Federal Aid Road Act." He was followed by C. O'Connor Goolrick, Chairman of the Legislative Roads Committee, which held a meeting as a part of the closing session of the Virginia Road Builders' Association. Mr. Goolrick spoke on the need for a state system of roads. E. W. James, of the U. S. Office of Public Roads and Rural Engineering, presented a paper on "Highway Maintenance," the discussion of which was led by S. L. von Gemmingen, Engineer of Maintenance of the Virginia State Highway Commission. Thursday's program also included the reports of officers and committees, the election of officers and the public meeting of the State Legislative Roads Committee.

One of the important resolutions passed at the convention was the recommendation to the legislature for the enactment of a law for taxing all vehicles using the public highways.

The name of the association was changed to "The Virginia Good Roads Association." W. G. Saunders, of Henrico County, was elected President, succeeding Otto L. Evans; J. B. Wood, First Vice President, and G. Tayloe Gwathmey, Second Vice President. C. B. Scott was reelected Secretary-Treasurer.

Texas Good Roads Association

The sixth annual convention of the Texas Good Roads Association was held at Austin, Texas, Jan. 17 and 18. Howard Bland, President of the Association, presided at the opening. Mayor Woolridge welcomed the visitors to Austin, and Judge J. A. King, of Albany, made the response.

Addresses were made during the convention by Earle B. Mayfield, Railroad Commissioner, and Judge Adrian Poole, of El Paso, the subject being the proposed bill for a state highway commission in Texas. R. L. Morrison, Professor of Highway Engineering, Agricultural and Mechanical College of Texas, spoke upon "Some Common Mistakes in Road Building," and other brief speeches were made by men identified with the good roads movement in Texas.

Mr. Bland was reelected President of the Association. The other officers elected were: Vice President, Sam Sparks, Austin; Secretary-Treasurer, D. E. Colp, San Antonio; Assistant Secretary, T. P. Grant, Brady; Directors: Howard Bland, Sam Sparks, D. E. Colp, J. W. Warren, Ben F. Keith.

Pikes Peak Ocean to Ocean Highway Association

The national annual convention of the Pikes Peak Ocean to Ocean Highway Association will be held at St. Joseph, Mo., Feb. 13 and 14.

Among the matters to be discussed are plans for perfecting extensions of the highway to Washington, D. C., New York City and Boston, and from Salt Lake City to the Pacific Coast; the placing of markers along the highway;

the publication of new maps and a "photolog" book; the improvement of various sections of the highway, and general road topics. The delegates to the convention will be the guests of the St. Joseph Chamber of Commerce and Automobile Club at dinner Tuesday, Feb. 13, and at luncheon Wednesday, Feb. 14.

A number of state organizations have recently held meetings. The Pennsylvania Division, known as the William Penn Highway Association, will meet at Reading, Pa., Jan. 29. The Missouri Division will hold its meeting at St. Joseph, Mo., Feb. 13.

Citizens' Street Traffic Committee of Greater New York

A meeting of the Citizens' Street Traffic Committee of Greater New York was held at the Automobile Club of America, New York, N. Y., on Wednesday evening of this week for the discussion of snow removal and pavement openings. Papers were presented as follows:

"Cooperation in Snow Removal," by John T. Fetherston, Commissioner of Street Cleaning, New York, N. Y.; "Cooperation in Snow Removal from the View-point of the Team Owner," by Joseph K. Orr, President New York Team Owners' Association; "Regulations Governing Pavement Openings in the City of New York," by George W. Tillson, Consulting Engineer to the President of the Borough of Brooklyn, New York, N. Y.; "Present Practice and Regulations Governing Pavement Openings Throughout the United States," by Arthur H. Blanchard, Professor of Highway Engineering, Columbia University; "Administration, Ordinances and Methods Recommended for Control of Pavement Openings in the City of New York," by Ernest P. Goodrich, Assistant Director, Bureau of Municipal Research, New York, N. Y

Kentucky County Road Engineers' Association.

The fifth annual meeting of the County Road Engineers' Association of Kentucky was held at Bowling Green on Jan. 17, 18, 19 and 20. W. H. Edwards, Road Engineer of Woodford County, presided at the opening session. In the absence of Mayor Patterson, whose illness prevented his presence, the address of welcome was delivered by Col. R. F. Dulaney, of the City Council. The response was made by J. Russell Gaines, Road Engineer of Jefferson County.

Among the speakers at the first day's session were Rodman Wiley, State Commissioner of Public Roads of Kentucky, who explained the object of the meeting. He said that there was no business in the United States which commanded more attention than the question of public roads. Eugene Stuart, Secretary of the Louisville Automobile Club, spoke on the importance of road maintenance with especial reference to trunk lines of travel. L. E. Yoder, Road Engineer of Harlan County, in his address on "Construction of Earth Roads," dealt with the wasteful use of road appropriations in the forty-eight states of the union, recommending that highway work be done by contract instead of force account. F. L. Duffy, Secretary of the Association, spoke on "Maintenance of Earth Roads." Dr. E. G. Dent, Director of the Jackson Highway Association, referred to the value of tourist traffic in promoting the improvement of highways.

At the morning session, Jan. 18, R. W. Davis, Road Engineer of Fayette County, presided. The principal addresses were made by P. L. Atherton, President of the Jackson Highway Association, Louisville, Ky., Rodman Wiley, and Col. Edmund Watson Taylor, Vice President of the Jackson Highway Association, of Frankfort, Ky. Mr. Atherton spoke on "Trunk Line Highways." Commissioner Wiley talked of Kentucky's progress in the good roads movement, and dealt with the types, mileage and costs of roads for which contracts have been let for 1917 work, stating that he had specified Feb. 15 as the last day upon which applications for state aid would be received from counties. He said that all preparations should be made during the winter and early spring, and for that reason no road plan should be approved after April 15, and no contract approved after June 1, except in very special cases. He also referred to the difficulty of securing necessary rights of way, and reminded the county road engineers present that they were all working for one end, and urged their fullest cooperation in order that both state and counties might receive the greatest benefits for funds appropriated for road building purposes.

On Thursday evening, Gov. A. O. Stanley delivered an address at the Opera House in Bowling Green, under the auspices of the County Road Engineers' Association, before a large audience consisting not only of delegates to the convention, but of residents of the city. He paid especial tribute to the present State Highway Department. This was followed by a reception at the home of Dr. E. G. Dent.

On Friday, the 19th, the delegates were invited to chapel exercises at the Western Kentucky State Normal School, by President H. H. Cherry. Commissioner Wiley presided. Brief speeches were made by Judge John B. Wilson of Ohio County, Judge Lancaster of Daviess County, and Judge Pickel of Laru County, and others. Friday's session was held at the Opera House, J. W. Spurrier, Road Engineer of Daviess County, presiding. R. W. Davis, the first speaker, talked on "Resurfacing Roads with Kentucky Rock Asphalt." Followed addresses by S. R. Murray, Asphalt Expert of Fayette County, on "Bituminous Roads"; R. E. Toms, U. S. Highway Engineer, on "Bituminous Surface Treatments"; Chas. N. Snead, Bridge Engineer, Department of Public Roads, on "Concrete Bridges," and others. "The Dixie Highway" was the subject of an address by Tom Wallace, of the editorial staff of the Louisville "Courier-Journal."

The election of officers took place on Friday afternoon, and was as follows:

President, R. W. Davis; Vice Presidents, G. M. Middleton, Shelby County; J. R. Thompson, McCracken County; L. E. Yoder, Harlan County; E. O. Mills, Kenton County; J. S. Boggs, Madison County, and J. R. Poindexter, Madison County, in the order named; Secretary and Treasurer, F. L. Duffy.

Executive and Legislative Committee: J. R. Gaines, W. H. Edwards, W. P. Caldwell, B. F. Bedford, Fred Gesling, R. P. Duvalle.

The program for Saturday, Jan. 20, was arranged to be devoted to the inspection of roads in Warren and adjacent counties.

The complete program for the meeting, giving the subjects of papers and addresses not referred to above, was printed in "Good Roads" for Dec. 9, 1916, page 243.

It was decided to hold the next convention at Newport, Ky.

The Paving Program of Kings County, Cal., calling for 102.66 mi. of improved highway, has been in progress for thirteen months, and it is believed by the county authorities that the 61.66 mi. remaining unpaved will be completed by December, 1917.

On January 10 a delegation from North Huntingdon Township, Westmoreland County, Pennsylvania, called upon State Highway Commissioner Black for the purpose of securing information in regard to the prospects for state aid in their township to meet a bond issue which has been ordered for road improvement. The Commissioner informed them that the matter would be considered as soon as the state aid appropriation was definitely decided upon. Those representing the delegation were: Scott Fink, J. C. Blackburn, A. M. White and G. B. Smith, of the North Huntingdon Supervisors' Board; J. L. Reidinger, J. B. Gallagher, C. D. Sensenich, Dr. C. E. Taylor, C. H. Warnock and W. T. Moffitt.

GOOD ROADS

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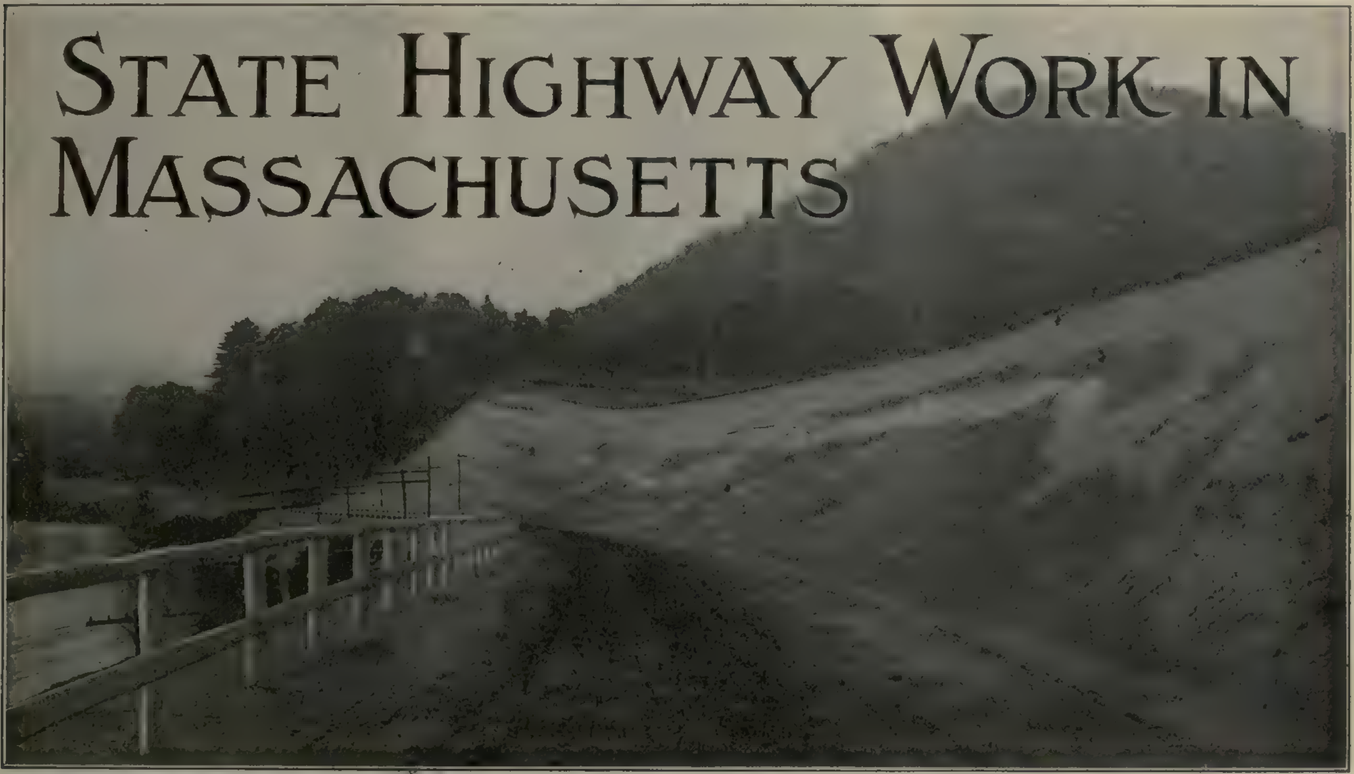
STATE HIGHWAY WORK IN MASSACHUSETTS



A SIDEHILL ROAD IN THE TOWN OF CHARLEMONT, MASSACHUSETTS—GRAVEL ROADWAY WITH COLD OIL SURFACE TREATMENT.

Between the sands of Cape Cod and the rugged peaks of the Berkshires can be found almost every physical condition that confronts the road builder in a northern commonwealth. In like manner, the road builders of Massachusetts are obliged to deal with varying local conditions of traffic, density of population and financial ability to meet the burden of paying for road betterment.

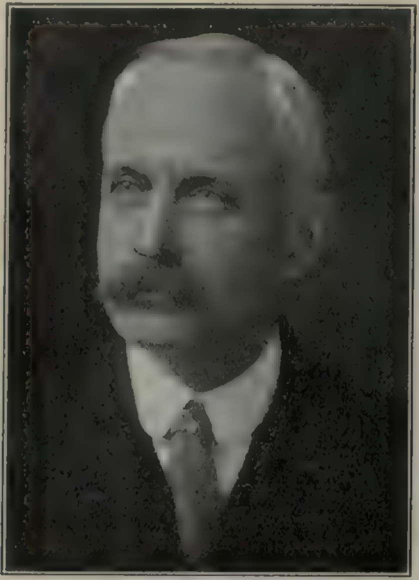
Most of the state is included in a roughly rectangular area about 50 mi. north and south by about 120 mi. east and west, and lying between about 42° and 42° 45′ north latitude and 70° 45′ and 73° 15′ west longitude. At the southeast there is a considerable area situated outside of this imaginary rectangle. In this are included Barnstable and Bristol Counties and most of Plymouth County. Barnstable lies on Cape Cod, a narrow sandy ridge extending easterly about 40 mi. and then northerly about 30 mi. into the sea, partly enclosing Cape Cod Bay. The total area of the state is about 8,266 sq. mi., of which about 277 are water. The broken, irregular coast gives the state a shore line of about 250 mi.

The western part of the state is rugged and mountainous, the Taconic and Hoosac Ranges extending across it in a general north and south direction and containing most of the elevated land in the state. At least 70 of the mountains and hills in the state have an elevation of 1,500 ft. or more above sea level, while 24 reach an elevation of 2,000 ft. or more. The highest peaks are Greylock, 3,535 ft., and Mt. Williams, 3,040 ft. Mt. Wachusett, further east and in comparatively level country, has an elevation of 2,108 ft. The Blue Hills at Milton are the only considerable elevations near the coast. Practically all of the area west of the Hoosac Mountains drains into the Housatonic River, which flows southerly through Massachusetts and Connecticut to Long Island Sound.

The central portion of the state is generally hilly and broken and includes the Connecticut Valley, which is separated from the Housatonic Valley by the Hoosac Mountains. The drainage here is into the Connecticut, which rises in northern New Hampshire and flows in a general southerly direction to Long Island Sound, forming the boundary between Vermont and New Hampshire, crossing Massachusetts about 45 mi. from its western boundary and practically bisecting the State of Connecticut.

In the eastern and southeastern sections of the state the country is generally undulating or level. The southeastern part—that earlier referred to as situated outside of the rectangle including most of the state—is a sandy lowland, generally level, with a slightly elevated ridge south of Plymouth. South of Cohasset, near Boston, the shore is sandy, with a few isolated rocky ledges and bowlders. In the neighborhood of Boston and to the north of it the shore is rocky and picturesque. The northern part of the coast section of the state drains in a general northeasterly direction into the Merrimac River; the central part easterly into the Charles and other rivers, and the southeasterly part in a general southerly direction into Buzzards and Narragansett Bays.

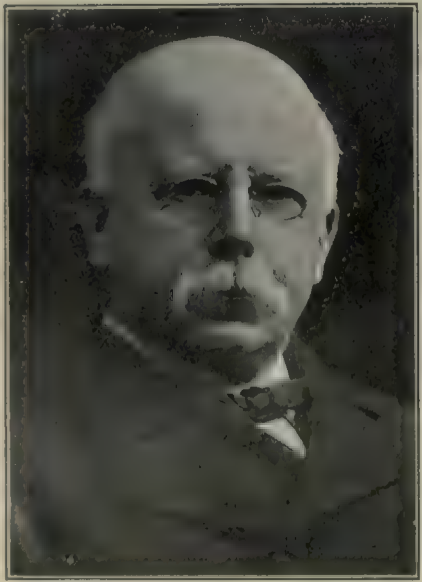
FRANK D. KEMP,
Member, Massachusetts Highway Commission.



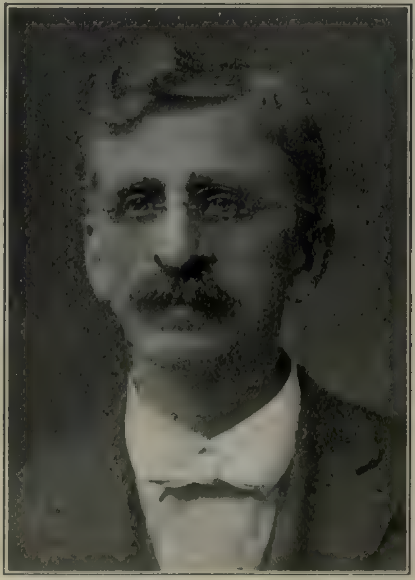
COL. WM D. SOHIER,
Chairman, Massachusetts Highway Commission.

Past and Present Members of the Massachusetts Highway Commission

JAMES W. SYNAN,
Member, Massachusetts Highway Commission.



DR. T. C. MENDENHALL,
Former Chairman, Massachusetts Highway Commission.



WILLIAM E. McCLINTOCK,
Former Chairman, Massachusetts Highway Commission.

The climate of the state shows wide variations, the temperature ranging from in the neighbood of —20° F. to perhaps +100° F. The mean average temperature of Boston is about 48 and the mean summer temperature of the state is about 70. Except in the valleys the soil is not naturally fertile. Hay, potatoes, corn, oats and tobacco are the principal crops, and in the vicinity of the larger cities truck gardening is an important business.

The chief mineral industry of the state is granite quarrying. There are many quarries and the value of the product is large. Trap rock, sandstone, and marble are also quarried.

Massachusetts is essentially a manufacturing state, the chief manufactures being textiles, boots and shoes, foundry and machine shop products, rubber goods, leather and paper.

There are about 18,500 mi. of public roads in Massachusetts, not including city streets. Over 70% of this mileage is improved and over 1,100 mi. are state roads. This latter mileage is the result of the 25 years of work by the State Highway Commission, for until just a quarter of a century ago there was no such thing as state highway work in Massachusetts. But any outline, however brief, of the progress since made by the state would be incomplete without some reference to road work in the early years of the commonwealth and there are available no more graphic accounts of conditions during that period than those written by two of the men most intimately acquainted with the early work of the commission—Geo. W. Perkins, the first chairman, and Wm. E. McClintock, a member of the first commission and the chairman of a later one. The latter, who is the only living member of the first commission, read a paper on road work of the early days at the road congress at Worcester in December of 1915. The followinng extract is from that paper, as is much of the other historical information elsewhere in this article.

> From its earliest permanent settlement, Massachusetts was an English colony. Not only was the language of the mother country used, but its laws, its customs and its method of doing things generally.
>
> Amongst the other things adopted was the method of building rural highways. A history of the rural highways of Massachusetts would much resemble a history of the rural highways of England, not those of modern times, but of the period previous to the days of McAdam and Telford, in the first quarter of the last century. This would hold true up to within about thirty years.
>
> There was but little inclination to do more than improve the older settlements, develop the unsettled areas and build the canals and railroads which would facilitate the transportation of goods to and from distant points.
>
> The large amount of money required for these various ac-

tivities left no available funds for improving the rural highways and comparatively little for city streets. The poor quality of the highways was recognized, but, aparently, no though was given to bettering; partly for the reason that they always had been bad and partly because nobody dreamed that sufficient money could be found with which to improve them.

Some of the immigrants of the nineteenth century were probably familiar with the broken stone roads of England, but no attempt was made to use such material here.

The invention of the stone crusher by Eli Whitney Blake, in 1857, and of the steam roller in 1860, would have materially aided in improving the rural highways, but the small communities fpr many years could not afford the large outlay of money necessary to purchase these useful implements. Occasionally a city or town would purchase a stone crusher; but the broken stone was not generally used in building broken stone roads but rather for filling up the very bad mud-holes or in slip-shod, useless patchwork.

No attempt was made to economize in breaking the stone. The crusher was set up at some convenient point on the ground and the stone as it fell from the jaws, unscreened, was shoveled into wheelbarrows and stacked up for future use.

Inasmuch as the roads were of dirt and the principal work on them was to dig out or plough the gutters and throw the loose material into the center, or haul similar material to or away from the road, the popular requisites for a road master were a knowledge of tilling the soil or driving a team. A thrifty farmer or teamster would not neglect his own work for the public; hence, the men ordinarily charged with the care of the roads were not always the most competent.

From the early days of the colony up to 1871 a man was permitted to work out his highway tax. This method might have been satisfactory to the individual but no lasting good roads came of it.

The brightest boys left the old farm and became successful professional and business men. On their occasional visits home they found the abominable roads of their boyhood days and accepted them as necessary evils.

Engineers and Secretary of the Massachusetts Highway Commission

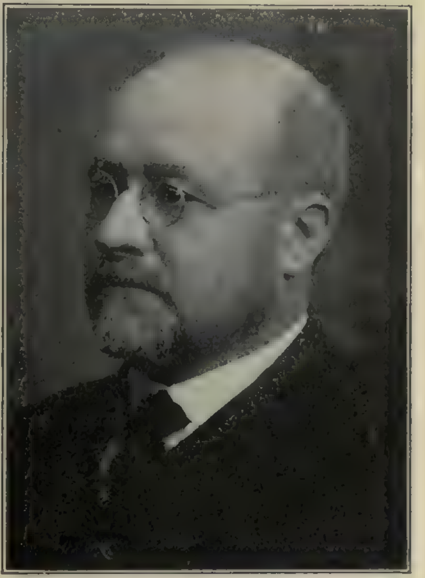
ANDREW M. LOVIS,
First Assistant Engineer.

F. C. PILLSBURY,
Division Engineer.

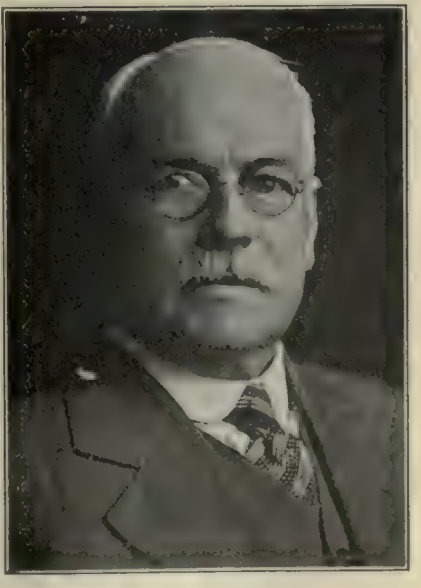
W. R. FARRINGTON,
Division Engineer.

A. W. DEAN,
Chief Engineer.

FRANK I. BIELER,
Secretary.



J. A. JOHNSTON,
Division Engineer.



C. H. HOWES,
Division Engineer.

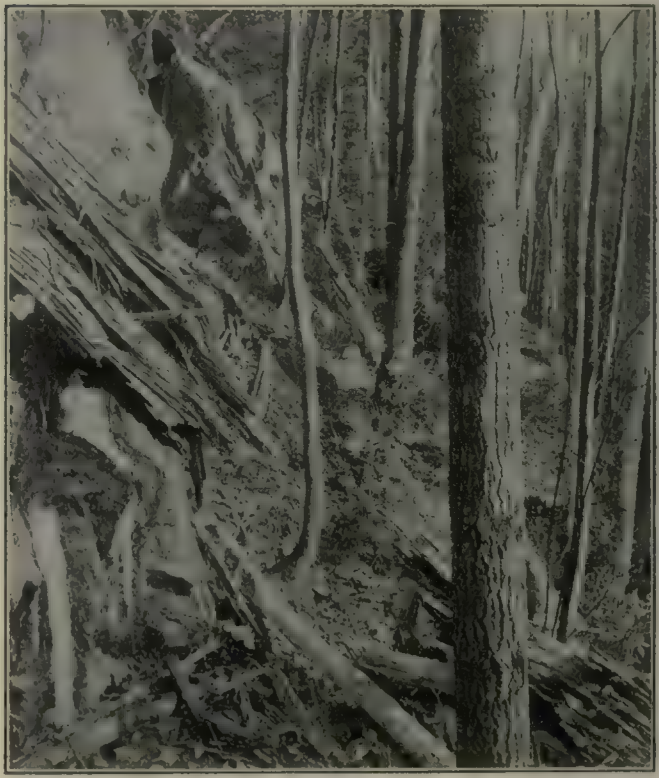
A BITUMINOUS MACADAM PAVEMENT ON A MASSACHUSETTS STATE ROAD IN TYNGSBOROUGH.

> With the advent of the bicycle came a change, slight while the high wheel ran its course, strong when the safety came into general use. An opportunity was then offered to men in the various professions, in business, in manufacturing, and men of leisure, to take long excursions out into the country, breathe in the pure, fresh air and get in close touch with nature. It did not take a long time before men of this character discovered the really bad condition of all roads and of the rural highways in particular.
>
> In the early 80's the number of wheelmen had increased sufficiently to demand better city streets. Then came the study which showed the tremendous economic waste resulting from bad roads. Through the wheelmen's efforts the efficiency of the road masters increased and finally the subject was taken up as a part of the civil engineer's work.
>
> During the 80's several of the cities installed crushing plants and purchased steam rollers. Then the necessity of separating the broken stone into sizes and saving the dust for binder was discovered. With this discovery the crushing plants began to be placed on some sidehill to permit of putting in screens and dropping the different sizes into bins.
>
> In the later 80's many of the cities began to build the modern broken stone road by breaking up the old roadway, shaping it and rolling with a steam roller until hard and smooth and then placing the stone in layers, the larger stone at the bottom, the ½-in. to 1½-in. over this, and the dust and screenings on top. Each course was rolled thoroughly and the top course was wet as well as rolled.
>
> In 1891 Mr. A. J. Wellington installed a large stone crushing plant at Salem. The crusher was set on a platform high in the air. There were bins to hold 1,000 tons of stone, each size by itself. These bins were set sufficiently high to permit railroad cars to pass underneath and be loaded from gates in the bottom of the bins. A railway from the quarry and inclined cable railway dropped the stone to be broken directly into the crusher. Other cable railways delivered the different sizes of rock fragments to their respective bins. The labor saving devices made it possible to produce and deliver broken stone in all parts of the commonwealth served by the Boston & Albany Railroad, at a reasonable cost.

VIEW ON THE MOHAWK TRAIL IN THE TOWN OF SAVOY —EARTH ROAD WITH OILED TOP.

> Within a few years similar plants at Waltham, Deerfield, Hingham, Westfield and Bridgeport furnished stone over all the various railroads serving the state.
>
> In 1891, the town of Spencer set up the first modern town plant, consisting of a rotary crusher, elevator and bins. Other towns and the cities soon fell into line until within a few years but few of the old style plants were to be found.
>
> The attention of road builders was first called to the necessity of selecting trap or other tough rock for roads at a meeting of the Boston Society of Civil Engineers in 1891, when the speaker now addressing you read a paper on the geology of road building. Later this subject was taken up by the state of Massachusetts and still later by the Good Roads Department at Washington.

The other account to which reference was made is entitled "State Highways in Massachusetts." It was written by Mr. Perkins and is found in the 1894 "Yearbook" of the U. S. Department of Agriculture. Part of it dealing with the early history of state road work in Massachusetts follows:



VIEW OF RIGHT OF WAY ALONG THE MOHAWK TRAIL—A SCENIC ROUTE IN WESTERN MASSACHUSETTS.

> In Massachusetts the question on a large scale was first brought before the legislature in 1887. The people had not been made to realize the great importance of a better and more complete system of highways, so that at first the matter was not given that serious consideration it deserved. It was conceded that the roads were not of the best, but it was claimed that the cost necessary to improve them would be too great for the smaller towns to bear. It was argued before the committee that much money was uselessly applied and wasted, and that there was an entire absence of systematic methods employed. It was shown that many towns were obliged to maintain long stretches of highways of little importance to them, but used as ways of communication between large centers. It was maintained that manufacturers, teamsters and farmers would be greatly benefited by the construction of a general system of roads, as the cost of transportation would be greatly reduced.
>
> The subject was annually brought before the legislature, each succeeding year finding a larger number of advocates. In 1892 the demand for action was so great that the legislature gave it particular attention, and its committee gave a number of public hearings which were largely attended by people from every section of the state, all agreeing that the

state should lend its aid and assistance toward the construction of and maintenance of certain highways. The legislature fully appreciated the force of the arguments, and, realizing the great scope of the subject, enacted a law providing for the appointment of a commission of three to inquire into the entire subject and report to the legislature of 1893, and granted a liberal appropriation for the purpose.

By the beginning of the last decade of the nineteenth century the need for systematic road improvement had begun to be realized. The use of the bicycle had brought the matter home to the people and the League of American Wheelmen had embarked upon an active and efficient campaign of education. "Good Roads," then the official organ of the league, a corps of able speakers and other means were employed by the organization, and its efforts bore fruit in many instances. In Massachusetts the result of the league's work was the act referred to by Mr. Perkins. It was passed by the General Assembly in 1892 and established a commission to investigate conditions and report back to the legislature. George A. Perkins, State Consul for Massachusetts of the League of American Wheelmen, who, with Col. Albert A. Pope, had been largely instrumental in securing the passage of the act, was appointed to the commission, the other members being Prof. N. S. Shaler and William E. McClintock. The commission organized early in July, 1892, and elected Mr. Perkins chairman.

THE MOHAWK TRAIL—FINISHED ROAD IN LOCATION SHOWN IN ILLUSTRATION AT THE LEFT.

The commission commenced work immediately, securing offices in Boston and obtaining information by sending out a series of blanks to local road officials, by securing reports from city engineers, by public hearings in different counties and by such other means as were available. At the hearings much information was obtained from the city and town officials and others interested in the matter of roads. The members of the commission also made a practice of giving short talks at these hearings, Mr. Perkins speaking on road economics, Prof. Shaler on road materials and Mr. McClintock on methods of construction and maintenance. A report of nearly 250 pages was prepared and submitted to the General Assembly of 1893. The report covered all phases of the road problem, including construction and maintenance, as well as methods of financing and administration. It showed that the chief obstacle to the improvement of the rural highways was lack of money, the data collected showing that 253 towns out of a total of 320 expended annually less than $100 per mile, while in 232 of these, the average annual expenditure per mile was less than $40.

A WATER BOUND MACADAM STATE ROAD IN THE TOWN OF BUCKLAND.

In accordance with the commission's report a bill was drawn up and submitted to the legislature. At hearings on the measure held by the roads and bridges committee of the legislature there was little opposition and in June, 1893, there was passed a bill providing for a highway commission. This commission was charged with the duty of investigating conditions, compiling road statistics, preparing maps of the state showing the roads and also information relative to the occurrence of road materials, collecting data on methods of construction, advising with municipal officials on the construction and maintenance of roads, and holding a hearing in each county in the state each year for the discussion of road matters, and reporting to the legislature. The commission was also authoried to take over and build such main highways as were petitioned for by county commissioners in the counties in which the roads were situated, providing the county at its own expense made surveys, rough graded the roads as directed by the commission and built all necessary bridges and culverts. Roads built in this manner were to be designated as state roads and were to be maintained by the commission at the cost of the state. Funds for this work were to be provided by specific appropriations by the legislature.

A GRAVEL AND OIL STATE ROAD IN THE TOWN OF RUSSELL.

CONCRETE ARCH BRIDGE OVER THE DEERFIELD RIVER IN CHARLEMONT.

A PATCHING GANG OF THE MASSACHUSETTS HIGHWAY COMMISSION WORKING ON A STATE ROAD.

In conformity with this bill Governor Russell appointed Messrs. Perkins, Shaler and McClintock members of the commission. Mr. Perkins was elected chairman and Austin B. Fletcher, the present State Highway Engineer of California, was made secretary. As the provisions of the law left the initiative with the counties, the commission was unable to proceed until petitioned by the county authorities. The latter resented what they felt to be an infringement on their rights and were also in some doubt as to the state of public opinion and the cost of the proposed work. As a result few petitions were presented and no state roads were built. The commission, however, did much work in advising with local authorities and in making inspections of all the main roads in the state.

During the following year the highway law was so amended as to give the selectmen of any town or the officials of any city, as well as the county commissioners, the right to petition the highway commission to take over a road as a state highway. Another amendment appropriated $300,000 for the use of the commission in constructing roads, thus obviating the necessity of a separate bill to provide the funds for each project.

Out of these original laws there grew the policy of improving comparatively short sections of road in various parts of the state—a policy which has been very generally followed up to the present.

The commission appointed in 1893 remained unchanged until 1896, when Dr. Thomas C. Mendenhall succeeded Mr. Perkins as chairman, Mr. McClintock and Prof. Shaler remaining. This commission served until 1898. The personnel of the commissions from that time to the present has been as follows: July, 1898, to August, 1900, Thomas C. Mendenhall, Chairman, William E. McClintock, Charles W. Ross; August, 1900, to June, 1908, William E. McClintock, Chairman, Harold Parker, John H. Manning; June, 1908, to June, 1909, Harold Parker Chairman, John H. Manning, William D. Sohier; June, 1909, to June, 1912, Harold Parker, Chairman, William D. Sohier, F. D. Kemp; June, 1912, to date, William D. Sohier, Chairman, F. D. Kemp, James W. Synan. Messrs. Perkins, Shaler, Ross, Manning and Parker are dead, Mr. Parker having died this winter.

The present highway law of the state is the law of 1893 with subsequent amendments, the general road law of the state, and various special acts of the legislature.

The highways of the state are divided into three classes: State highways, county highways and city and town highways. The county, town and city highways are under the control of the town and city authorities, a road superintendent or highway surveyor in each town and a street superintendent or similar official in each city having direct charge of the work. These officials are geneally appointed by the governing authorities—selectmen in the towns and mayors in the cities. The affairs of a town, outside of an incorporated city, are generally controlled by a board of three selectmen, elected by the people in February or March of each year. They take office upon election and generally serve for one year. Appropriations for road and street work are made by popular vote in towns and cities.

WARRENITE PAVEMENT LAID ON OLD MACADAM AT CHICOPEE.

A SAND-OIL STATE ROAD IN THE TOWN OF ROCHESTER, PLYMOUTH COUNTY.

County commissioners, upon petition, may lay out new highways or make specific improvements on existing highways. They may also direct town or city authorities to do certain work or may themselves perform the work and assess a portion of the cost upon the town or city benefited.

State highways are built and paid for by the state acting through the State Highway Commission. The money required is raised by bond issues from which appropriations are made by the legislature. State road improvement is undertaken by the state upon petition from county, town or city authorities. When completed, state roads are maintained at the expense of the state and are entirely under state control.

In addition to having charge of state road work the commission has control of the registration of motor vehicles and the licensing of operators. The net proceeds from automobile licenses and fines are used for the maintenance and repair of roads, 80% being used for state roads and the remaining 20% for other roads connecting towns or cities.

Besides devoting a part of its automobile funds to the repair and maintenance of roads other than state highways, the commonwealth extends financial aid to the towns in the construction of certain roads. Under the law making provision for this—the so-called "small town" act—15% of the amount appropriated in any year for road construction may be expended in this manner. The total funds so available are apportioned to towns, upon petition, as follows: One-third in towns of less than $1,000,000 valuation, with no contribution from the town; one-third in towns of less than $1,000,000 valuation, the town contributing an equal amount; and one-third to towns of over $1,000,000 valuation, the town contributing an equal amount. Roads built in this manner are maintained by the towns in which they are situated.

The legislature of 1915 passed a bill creating a commission to report on a codification of the existing road laws and recommendations for changes. The commission consists of the three members of the State Highway Commission, three county commissioners, and one layman appointed by the governor. The commission is to report at the present session.

The State Highway Commission consists of three members appointed by the governor with the advice and consent of the council. They serve for three years. One, appointed as chairman, receives an annual salary of $5,000, and the other two receive $4,000 each. The executive officer of the commission is the chief engineer, who is appointed by the commission.

The present personnel of the State Highway Department is as follows:

State Highway Commission: William D. Sohier, Chairman; Frank D. Kemp, James W. Synan.

Secretary, Frank I. Bieler.

Chief Engineer, A. W. Dean; First Assistant Engineer, Andrew M. Lovis.

Division Engineers: C. H. Howes, Greenfield; J. A. Johnston, Springfield; F. C. Pillsbury, Boston; W. R. Farrington, Middleboro.

Up to Nov. 30, 1916, the commission had expended a total of about $11,644,000 for the construction of state highways, including the planting of trees. Under the law 25% of the state's expenditure is paid back by the counties, so that the actual expenditure of state funds for construction from the beginning of the work to the date given above was approximately $8,733,000.

The appropriations made for the construction and repair of state highways since the establishment of the commission are shown in Table I.

On Sept. 30, 1916, the total amount of bonds issued to provide funds for road work was $10,002,000. As the sinking fund established by law to retire the bonds amounted to $3,057,768, the net indebtedness was $6,944,232. As the amount the commission is authorized to expend—and the state to borrow—was increased from $500,000 annually to $1,000,000, beginning with the year ending Nov. 30, 1913, as shown in the table, the amount expended during 1913, 1914 and 1915, amounted to between 25 and 30 per cent. of the entire cost since the work was begun.

The legislature of 1912, which authorized the increase just noted, also increased the amount to be used for "small town" work from $75,000 to $150,000 annually, this also for a 5-year period. This is a very important part of the commission's work and from its inception to Nov. 30, 1915, entailed an expenditure of about $1,732,000, of which about $1,017,000 was expended by the state, the balance being appropriated by the towns in accordance with the provisions of the law. The money has been used for the improvement of about 480 mi. of road in 185 towns. The laws governing this work were passed in 1900 and 1901.

TABLE I.—APPROPRIATIONS FOR THE CONSTRUCTION AND REPAIR OF MASSACHUSETTS STATE HIGHWAYS.

Year Appropriated	Amount Appropriated
1894	$300,000
1895	400,000
1896	600,000
1897	800,000
1898	400,000
1899	500,000
1900	500,000
1901	500,000
1902	500,000
1903 (for construction for 5 years)	2,250,000
1907 (for construction for 5 years)	2,500,000
1912 (for construction for 5 years)	5,000,000
Total	$14,250,000

A specific appropriation for maintenance was first made in 1903, when $40,000 was designated for that purpose. The maintenance appropriations to and including 1915 are shown in Table II.

TABLE II.—APPROPRIATIONS FOR THE MAINTENANCE OF MASSACHUSETTS STATE HIGHWAYS.

Year Appropriated	Amount Appropriated
1903	$ 40,000.00
1904	50,000.00
1905	60,000.00
1906	64,166.66
1907	100,000.00
1908	150,000.00
1909	250,000.00
1910	200,000.00
1911	200,000.00
1912	200,000.00
1913	200,000.00
1914	250,000.00
1915	250,000.00

In 1914 and in 1915 and again in 1916 an additional appropriation of $100,000 was made for widening and resurfacing. In addition to the $415,000 available, made up of this $100,000 appropriation and the $315,000 appropriated for ordinary maintenance, the commission had at its disposal about $1,000,000 from motor vehicle fees, making a total of about $1,415,000 annually to be expended for maintenance, resurfacing and widening.

The roads built under the supervision of the Highway Commission are principally gravel, gravel with oiled surfaces, water bound macadam, water bound macadam with bituminous surfacing, and bituminous macadam. In addition to these, comparatively small amounts of other types are built, among these being roads of gravel with the upper portion bound with bituminous materials, sand with bituminous binders, cement concrete, and earth.

In general, the usual methods of construction are followed, Massachusetts practice differing but little from that of other states. Special mention, however, should be made of the sand-oil roads. These are built chiefly in those sections of the state where the soil is sandy, as on Cape Cod and in a few other localities. This work was commenced about eleven years ago and has yielded very satisfactory results. Roads of this type are of two kinds—those built by the layer method and those built by the mixing method. Briefly described, the former type is a road built up of successive layers of sand and oil, mixed on the road. The mixed roads, as the name implies, are those built by mixing the sand and oil and laying the mixture on the road, as in bituminous concrete construction. A detailed description of the methods of constructing roads of the sand-oil type was printed in a recent number of "Good Roads." ["Sand-Oil Roads in Massachusetts," by W. R. Farrington, "Good Roads," Nov. 4, 1916, page 192.]

Maintenance is given the most careful attention by the commission. Section men or repair gangs are employed on practically all the state highways, patching, and the application of bituminous coverings forming the greater part of the work.

"General Highway Traffic Law" Proposed for New York State

A bill providing for uniform traffic regulations, to be known as the "General Highway Traffic Law" was introduced in the New York State Assembly by Assemblyman Clarence F. Welsh on Jan. 12 last and was referred to the Committee on Internal Affairs. The bill purports to provide for the "uniform regulation of vehicles, animals and pedestrians on any public highway in the state."

Article 1 contains the short title of the law and the definitions of terms used therein.

Article 2 contains the following sections: 10—Pedestrians; 11—Stopping, turning, passing and waiting of vehicles; 12—Right of way and operation of vehicles; 13—Signals; 14—Speed regulations; 15—Parking, safety zones and cab stands; 16—Loading and unloading vehicles; 17—Vehicles; 18—Control, treatment and condition of horses; 19—Street surface cars; 20—Motorcycles, bicycles and similar vehicles; 21—Miscellaneous regulations; 22—Duties of local authorities; 23—Powers of local authorities.

Section 10 provides that pedestrians shall be subject to all the rules governing vehicles as to meeting, turning out and passing; and among other things that "Pedestrians shall have the right to cross the streets and highways, but they shall do so at their own risk, except at street intersections or at regular or designated street crossings on which they shall have the right of way over vehicles unless otherwise directed by the warning or signal of a police officer."

Section 11 provides for turning corners, turning to the left into another street, and that "in turning a corner of intersecting streets in a congested district a vehicle shall be driven with extreme caution and under control"; that "a vehicle shall not back to make a turn if it obstructs traffic, but shall go around the block or to a street wide and clear enough for the purpose"; that "a vehicle in overtaking or meeting a street surface car which has been stopped for the purpose of receiving or discharging passengers, shall not pass or approach within 7 ft. of such car so long as such car is stopped; and that except at street intersection where a traffic officer is on duty, no two vehicles shall stand or drive abreast, unless the roadway is sufficiently wide to permit passing in safety."

Section 12 provides that right of way be given to United States mail, police, fire, fire patrol, bureau of buildings, emergency repair of public service corporations, ambulances and the military, and requires that two vehicles passing each other in opposite directions shall have the right of way, and among other things requires slowly moving, large or heavily loaded vehicles to move as near to the curb as possible, and that rapidly moving, smaller and lighter vehicles occupy the space lying immediately next to and parallel with the middle of the highway. It prohibits the use of a motor muffler cut-out within the limits of a city or incorporated village, and gongs and siren whistles by other than the police or fire departments, sheriff, or other public vehicles on emergency calls.

Section 13 requires that drivers, before turning to right or left, decreasing speed or stopping, shall give warning to those following either by signalling with the arm, or operating an adequate mechanical device, and makes other provisions.

Section 14 prohibits reckless driving, and authorizes local authorities to make and enforce reasonable ordinances regulating the speed of vehicles, and requires them to have erected legible and visible signs warning drivers of the approach to a bridge, fire house or school house. It also provides that street surface cars shall be brought to a full stop and that other vehicles shall proceed with caution when approaching a crossing or place designated by the sign "Traffic Point."

Section 15 regulating safety zones, parking, etc., prohibits the stoppage or standing of a vehicle within the intersection of a cross street, within 10 ft. of any crosswalk or street corner or alley crossing, except where traffic officers are on duty, and in certain other places, and prohibits driving across a sidewalk except over a duly authorized and constructed driveway.

Sections 16 and 17 regulate the use of loaded vehicles, marking of loads extending beyond the rear of the vehicle, width of vehicle, and prohibits the use of a vehicle so loaded with iron or other material as to creat loud noises while in transit.

Section 19, among other things, requires that street surface cars during blockades or stoppages shall leave a clear space of 10 ft. open between the cars, opposite an alley or in the center of the block.

Section 20 confines the use of motorcycles, bicycles, and similar vehicles to the street, and makes other requirements as to signals.

Section 21 prohibits races or contests for speed upon any street without proper permission of state, county or city authorities or the operation of a vehicle in such a way as to emit unnecessary smoke or offensive vapors.

Section 23 empowers local authorities to make, enforce and maintain reasonable ordinances governing the movement of traffic, but provides that: "Local authorities shall have no power to pass, enforce or maintain any ordinance, rule or regulation in any way in conflict with, contrary to, or inconsistent with the provisions of this chapter, or any general law which has or hereafter may be enacted, and no such ordinance, rule or regulation of such local authorities now in force or hereafter enacted shall have any force or effect."

Article 3 contains sections on penalties for violating any provisions of the law, and the publication and distribution of regulations, and provides that the law shall take effect immediately.

Grade Crossing Elimination in Texas

A bill has been introduced in the legislature of Texas proposing that railroads be required to do away with all highway grade crossings within the state.

As it would be impracticable, on account of the enormous expense involved, to have all of the work done at once, the intention is to eliminate the more dangerous crossings first. According to advices recently received, the State Railroad Commission is supporting the measure. The plan of the railroad commission is to have its engineers make a complete survey of the highway and railroad grade crossings of the state. Each of the more important railroads, it is stated, will be required to spend approximately $250,000 a year on the work, and the bill provides that the counties along the respective lines shall be required to spend an equal amount for the purpose.

BOSTON AND ITS STREETS

By Joshua Atwood

GENERAL VIEW OF THE WATERFRONT OF BOSTON, MASSACHUSETTS—THE 1917 CONVENTION CITY OF THE AMERICAN ROAD BUILDERS' ASSOCIATION.

Since the days of William Blackstone, the first settler, no city in the world has undergone more changes in its physical conformation than the City of Boston, Massachusetts. By leveling and filling, the original peninsula has been almost trebled in area and has so changed that hardly a foot of the shore line of the old Boston remains. The most lucrative public improvement was the reclamation of the Back Bay section and its transformation into one of the most beautiful residential sections in America. Of late years it must be admitted that the trend of business, especially that of the automobile, is towards and into this section of the city.

The natural advantages of Boston as a seaport and railroad center in our own day were comprehensively set forth by the City Surveyor of Boston, in 1893, as follows:

"Boston is the only direct seaport outlet, by position and other great natural advantages resulting from its excellent and sheltered harbor, of all the section of the country comprised within the territory of the New England states, the great Northwest, and the Canadian provinces lying north and east of the Great Lakes.

"The original shore line of the city proper so favored railroad approaches, that within a circle described by a radius of less than half a mile around the business center of the city are located the great terminal stations of the Fitchburg, the Boston & Maine, the New York, New Haven & Hartford the Boston & Albany, and the New York & New England Railroads (on lands reclaimed from the sea), so that it may be said that these great arteries connecting the city with the territory drained by these trunks, their branches, feeders, and connecting lines, penetrate to the very heart of the business community; an advantage of no mean importance in measuring the situation from the standpoint of the commercial competition of our nearest neighbors.

"Thus to inland commerce, the city proper occupies a concentric location much resembling the hub of a wheel, from which these trunk lines of railroad radiate like spokes, while to international trade the same section lies in an eccentric position to the great ship basin, a combination which, for rapid and economic distribution, could not well be excelled in this age of concentration and economy of time and space."

The first street paved in Boston was Washington St., about the year 1650, the material being "pebbles." A portion of State St. was paved previous to 1684 and quite an amount of pavement was laid in the latter part of the seventeenth century. Drake's "History of Boston" says that on March 9, 1657, the General Court ordered "the paved lane by Mrs. Shrimpton's to be laid open and no more to be shut up." Of all the streets of New England there is none which can boast of a more notable history than Washington St. This was Boston's first thoroughfare and began with the beginning of Boston. It was the only avenue to the mainland and was composed of twisting roads and paths through the length of the originally pear-shaped peninsula and was distinctively the first Boston main street.

Under the administration of Josiah Quincy, between 1823 and 1826, extensive public improvements were made in the vicinity of Dock Square and six new streets were added to Boston—South Market St., North Market St., part of Commercial St., Clinton St., Merchants Row and Chatham St.

Atlantic Ave. was projected in 1868 and the filling completed in 1874. The material of which this avenue was made came from the cutting down of Fort Hill, an eminence 50 ft. high. With the exception of Washington St., this avenue was one of the most expensive streets ever laid out by Boston, the total cost being $2,400,000.

TABLE I.—DATA ON GROWTH OF BOSTON.

	1915	*Increase from 1865.	Per Cent of Increase	
			1865-1915	1890-1915
Population*	745,439	553,121	286.12	66.22
Valuation	$1,573,164	$1,201,271	323.02	91.37
Bank Clearing	8,256,936	5,915,047	252.58	60.93
Commerce:				
Total	260,129	214,160	487.84	94.01
Imports	152,653	128,112	525.89	142.78
Exports	107,476	86,047	449.11	50.94
Tonnage	4,124	2,794	210.11	66.38
Manufactures (1914)				
Value of Products	284,802	193,852	213.14	35.02

*Excepting population, 000's are omitted in the table.

CITY OF BOSTON

TABLE SHOWING LENGTH AND AREA OF PAVING ON ACCEPTED STREETS CORRECT TO FEBRUARY 1, 1916.

	LENGTH IN MILES											AREA IN SQUARE YARDS										
	ASPHALT	GRANITE BLOCK	WOOD BLOCK	PLANK ON BRIDGES	BRICK	COBBLE	BITULITHIC	MACADAM	GRAVEL	NOT GRADED	TOTALS	ASPHALT	GRANITE BLOCK	WOOD BLOCK	PLANK ON BRIDGES	BRICK	COBBLE	BITULITHIC	MACADAM	GRAVEL	NOT GRADED	TOTALS
YEAR 1914 REPORT	21.65	101 15	7.18	[illegible]	5.33	0.21	11 05	392 36	40.77	2.96	584.56	321116	2 323673	175868	40205	110863	1687	209958	7094252	623230	108470	11,009,322
PER CENT	3.70	17.30	1.23	0 33	0.81	0 04	1 89	67.12	[illegible]	0.51	100 00	2 92	21.10	1.60	0.36	1.01	0.02	1.91	64 44	5.68	0 98	100 00
FEBRUARY 1, 1916 CITY PROPER	15.46	41.28	6.10	0.39	0.60	0 12	5.47	25.23	0.02		94.67	219571	938079	152784	9 236	8019	1171	110699	529119	95	104	1968 877
CHARLESTOWN	0 32	11.88	0.06	0.13	0.10			10 90	0.02		23.41	5173	[illegible]	1418	3 091	2296			162 421	275		440 780
EAST BOSTON	0.11	6 44		0.11	0.04	0 06	0.03	23.62	1.47	0.03	31.91	1865	137642		1799	950	396	558	504607	31845	661	680323
SOUTH BOSTON	1.94	18.76	0.16	0.32	0.13		1.05	20.99	0.69	1 45	45.49	22704	440863	2 850	6 967	1979		18 235	397452	12903	39243	[illegible]
ROXBURY	3.15	13.63	1.14	0.05	2.69		2 41	64 21	2.44	0.23	89.95	57668	317125	24443	1417	50352		37 811	1106 448	33311	4 739	1633 314
WEST ROXBURY	0.66	1.73		0.11			0.65	86 75	6.50	0.40	96.80	10183	45570	583	2 181			11 988	1442103	95373	25205	1 633 186
DORCHESTER	1.45	7.65	1.46	0.24	1.34		1.80	106 47	8 04	0.71	129.76	21480	168262	37309	5 579	48208		30122	1818716	129046	21970	2 280692
BRIGHTON	0.15	0.64	0.04	0.25			0.70	39.48	5 13	0.09	46.48	2915	16323	2505	4 351			14 894	843601	78028	8 880	[illegible]
HYDE PARK		0.08		0.30				18 80	15.73	0.24	35.15		1661		5302				346205	238426	8 567	601161
TOTAL	* 23.24	† 102.09	8.96	1.90	5.50	0 18	12.11	⊕ 396 45	40 04	3 15	593 62	* 341559	† 2 331631	221892	39923	111804	1567	224307	⊕ 7160672	619302	110369	11153026
PER CENT	3.91	17.20	1 51	0 32	0.93	0 03	2 04	66.79	6 74	0.53	100.00	3.06	20.91	1.99	0.36	1.00	0.01	2.01	64.12	5.55	0 99	100.00

TOTAL PUBLIC STREETS 593.62 MILES.

NOTE:- IN THE ABOVE TABLE THE CITY IS SUB DIVIDED SUBSTANTIALLY ON THE BOUNDARY LINES BETWEEN THE DISTRICTS AS THEY EXISTED WHEN ANNEXED TO BOSTON. TERRITORY ANNEXED FROM BROOKLINE IS INCLUDED IN CITY PROPER.

* OF THIS AMOUNT 0 02 MILE OR 81 SQUARE YARDS — ASPHALT BLOCKS.

† OF THIS AMOUNT 23 56 MILES OR 621377 SQUARE YARDS = GRANITE BLOCK PAVING ON CONCRETE BASE.

⊕ OF THIS AMOUNT 0 03 MILE OR 672 SQUARE YARDS - HASSAM CONCRETE PAVEMENT
AND 0 06 MILE OR 946 SQUARE YARDS - BLOME GRANITOID CONCRETE BLOCKED PAVEMENT,
AND 80.90 MILES OR 1690001 SQUARE YARDS = BITUMINOUS MACADAM,
AND 0 08 MILE OR 1250 SQUARE YARDS = ROMAN ROAD PAVEMENT.

5.23 MILES OR 28741 SQUARE YARDS PUBLIC ALLEYS INCLUDED IN THIS TABLE.

6.24 MILES OR 261422 SQUARE YARDS PUBLIC STREETS IN CHARGE OF PARK AND RECREATION DEP'T INCLUDED IN THIS TABLE

[illegible] MILES OR 48474 SQUARE YARDS PUBLIC STREETS IN CHARGE OF THE COMMONWEALTH OF MASSACHUSETTS INCLUDED IN THIS TABLE.

IN ADDITION TO THIS TABLE THERE ARE 1.29 MILES OR 6758 SQUARE YARDS ACCEPTED FOOTWAYS

TABLE II.—PAVEMENT ON BOSTON STREETS TO FEB. 1, 1916.

EDWARD F. MURPHY
Commissioner of Public Works

JOHN M. SHEA
Chief Engineer, Paving and Sewers

JOSEPH J. NORTON
Supervisor of Street Cleaning and Sanitary Service

As early as 1853 the inventive genius, the man with the patent, made his entry and did succeed in inducing the authorities in Boston to lay an iron block pavement in Court St., between Washington St. and the Court House, at a cost of $10 per sq. yd., and in Washington St., between Court St. and School St., at a cost of $6 per sq. yd. The paving blocks used were known as the Terry "heavy" and the Terry "light" blocks. The heavy block was 12 in. square by 5½ in. deep and weighed 36 lb.; the light block was 14 in. square by 4½ in. deep and weighed 31 lb. This pavement gave satisfaction for a short time, but after a couple of years went to pieces and had to be removed.

JAMES M. CURLEY
Mayor

The Mayor and the Principal Street Officials of the Bureau of Public Works of Boston, Massachusetts

Table I affords a comparative view of the increase in population, assessed valuation and certain outstanding business interests of Boston in the half century since the close of the Civil War.

Boston has an area of 47.92 sq. mi., of which the land area is 43.36 sq. mi., or 27,612 acres. Original Boston contained about 780 acres of land.

The total length of the 2,357 paved streets, Feb. 1, 1916, was 593.62 mi.; total area 11,153,026 sq. yds., or 8.38% of the city's total land area. This is exclusive of the private streets, those which have not been accepted by the city, numbering about 2,700.

The estimated division of land acreage is as follows: Occupied by buildings, 8,755 acres, or 31.7% of all land; public and private streets, etc., 6,100 acres, or 22.1%; parks, parkways, playgrounds, etc., 3,600 acres, or 13%; public lots and vacant ground, 1,229 acres, or 4.5%; private lots and yards, 7,928 acres, or 28.7%; total area, 27,612 acres.

Table II shows the length and area of paving on all accepted streets to Feb. 1, 1916.

JAMES H. SULLIVAN
Division Engineer, Highway Division

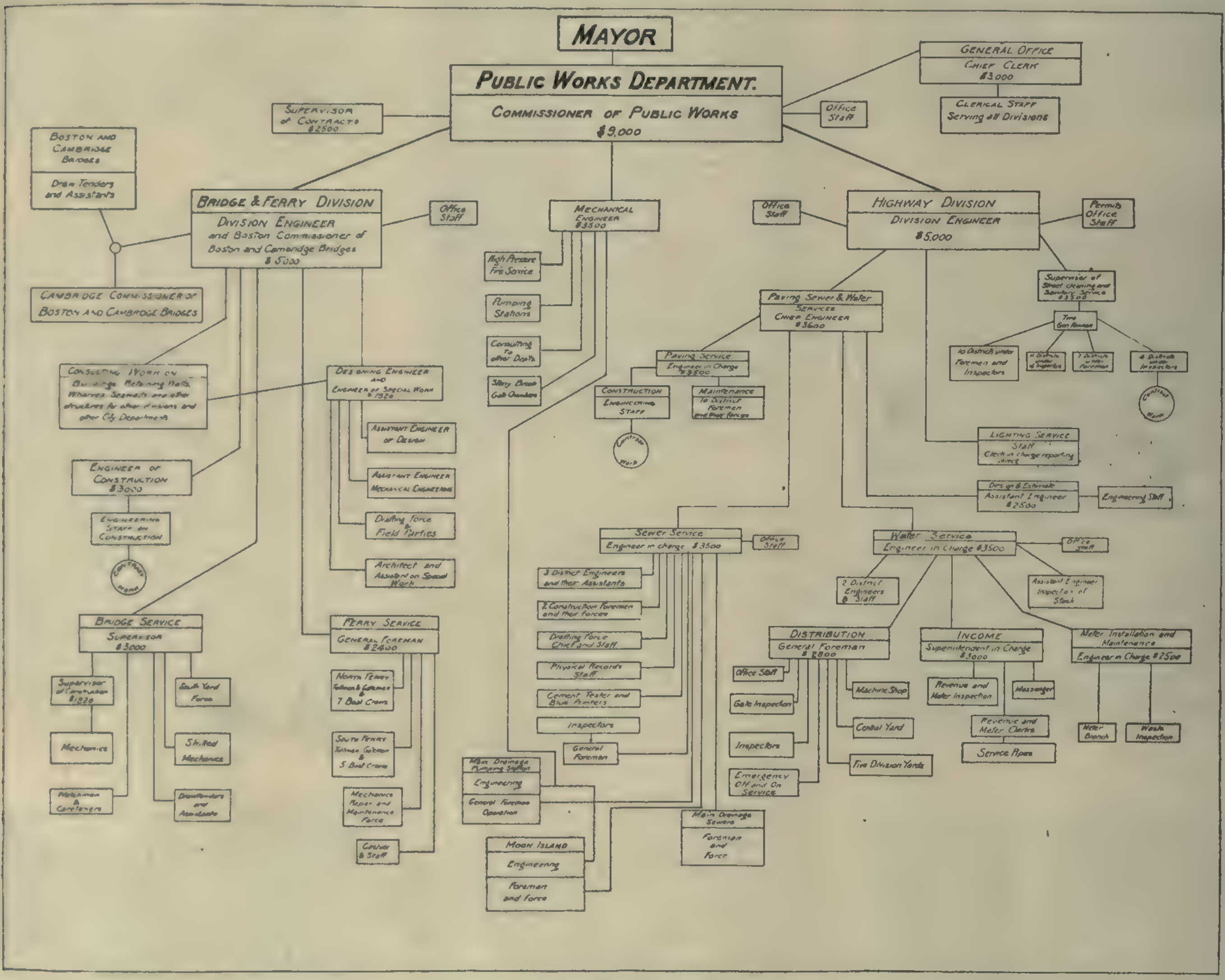
JOSHUA ATWOOD
Engineer in Charge, Paving

JOHN E CARTY
Division Engineer, Bridge and Ferry Division

In order that greater efficiency might be secured in the work of the Engineering, Water and Street Departments, an ordinance was passed by the City Council, Nov. 14, 1910, taking effect Feb. 1, 1911, establishing the Department of Public Works, and abolishing the Engineering Department, the Water Department and the Street Department.

A reorganization was effected Jan. 24, 1916, by which the Sewer Division and Water Division were consolidated. The organization of the Public Works Department in 1916 is shown in the accompanying chart.

The present officials of the Department of Public Works are: Commissioner, Edward F. Murphy; Division Engineer, Highway Division, James H. Sullivan; Division Engineer Bridge and Ferry Division, John E. Carty; Chief Clerk, Bernard C. Kelley; Supervisor of Contracts, William J. McGlinchey; Engineer in Charge, Paving Service, Joshua Atwood; Engineer in Charge, Sewer Service, Thomas F. Bowes; Engineer in Charge, Water Service, Christopher J. Carven; High Service Mechanical Engineer, Joseph A. Rourke; Bridge Service Supervisor, Thomas J. Sexton; Street Cleaning and Sanitary Service, Supervisor, Joseph J. Norton; Strandway Improvement, Engineer in Charge, Leo Bayles Reilly; Chief Engineer, John M. Shea.



MAYOR
PUBLIC WORKS DEPARTMENT.
COMMISSIONER OF PUBLIC WORKS $9,000
SUPERVISOR of CONTRACTS $2500
Office Staff
GENERAL OFFICE
CHIEF CLERK $3,000
CLERICAL STAFF Serving all Divisions
BOSTON AND CAMBRIDGE BRIDGES
Draw Tenders and Assistants
BRIDGE & FERRY DIVISION
DIVISION ENGINEER and Boston Commissioner of Boston and Cambridge Bridges $5000
Office Staff
CAMBRIDGE COMMISSIONER OF BOSTON AND CAMBRIDGE BRIDGES
CONSULTING WORK ON Buildings Retaining Walls Wharves Seawalls and other structures for other divisions and other City Departments
DESIGNING ENGINEER AND ENGINEER of SPECIAL WORK $1920
ASSISTANT ENGINEER OF DESIGN
ASSISTANT ENGINEER MECHANICAL ENGINEERING
Drafting Force & Field Parties
Architect and Assistant on Special Work
ENGINEER OF CONSTRUCTION $3000
ENGINEERING STAFF ON CONSTRUCTION
Contract Work
BRIDGE SERVICE
SUPERVISOR $3000
Supervisor of Construction $1920
South Yard Force
Mechanics
Skilled Mechanics
Watchmen & Caretakers
Drawtenders and Assistants
FERRY SERVICE
GENERAL FOREMAN $2400
NORTH FERRY Tollmen & Gatemen & 7 Boat Crews
SOUTH FERRY Tollmen Gatemen & 5 Boat Crews
Mechanics Repair and Maintenance Force
Cashier & Staff
MECHANICAL ENGINEER $3500
High Pressure Fire Service
Pumping Stations
Consulting to other Depts
Stony Brook Gate Chambers
HIGHWAY DIVISION
DIVISION ENGINEER $5,000
Office Staff
Permits Office Staff
Supervisor of Street cleaning and Sanitary Service $3500
Two Gen. Foremen
10 Districts under Foremen and Inspectors
4 Districts under Inspectors
Contract Work
Paving Sewer & Water SERVICES
CHIEF ENGINEER $3600
Paving Service
Engineer in Charge $3500
CONSTRUCTION
ENGINEERING STAFF
Contract Work
Maintenance
To District Foremen and their forces
LIGHTING SERVICE
Staff
Clerk in charge reporting direct
Design & Estimate
Assistant Engineer $2500
Engineering Staff
Sewer Service
Engineer in charge $3500
Office Staff
3 District Engineers and their Assistants
2 Construction Foremen and their forces
Drafting Force Chief and Staff
Physical Records Staff
Cement Tester and Blue Printers
Inspectors
General Foremen
Main Drainage Pumping Station
Engineering
General Foreman Operation
MOON ISLAND
Engineering
Foreman and force
Main Drainage Sewers
Foremen and Force
Water Service
Engineer in Charge $3500
Office Staff
2 District Engineers & Staff
Assistant Engineer Inspector of Stock
DISTRIBUTION
General Foreman $2800
Office Staff
Gate Inspection
Inspectors
Emergency Off and On Service
Machine Shop
Central Yard
Five Division Yards
INCOME
Superintendent in Charge $3000
Revenue and Meter Inspection
Messenger
Revenue and Meter Clerks
Service Pipes
Meter Installation and Maintenance
Engineer in Charge $2500
Meter Branch
Waste Inspection

ORGANIZATION CHART—PUBLIC WORKS DEPARTMENT, BOSTON, MASS.

The Highway Division has charge of the construction and maintenance of roadways and sidewalks; the collection and removal of ashes, garbage, refuse and street cleaning; the care of lamps and lighting of streets, parks and alleys; the construction of sewers, catch basins and waterways; the care of the water supply owned by the city; the installation of meters and water services and the laying and relaying of water mains.

The Bridge and Ferry Division has the charge and care of all bridges used as highways, which are, in whole or in part, under the control of the city; the care and management of the ferries owned by the city, including boats, slips, drops and buildings.

The accounting force of the department is merged into one body under the charge of the Chief Clerk. A separate office is maintained where all complaints, such as defects in streets, etc., the non-removal of ashes and offal, watering and oiling of streets, etc., are received and from there forwarded to the proper person for attention.

The city is divided into eleven highway districts, each in charge of general foremen and other necessary employees. In the Paving Service this district force spends most of its energies in repairing and maintaining existing street surfaces, though it is also used in new construction

The City of Boston has from the beginning of its corporate existence in 1822, made use of what is known as the "lump sum budget," according to which the appropriations are voted as aggregates for each department or main division of a department. Pursuant to an order passed by the City Council on June 7, 1915, and approved by the Mayor June 8, a commission was appointed to investigate and report upon "the expediency of adopting a segregated form of budget for the departments for which the city makes appropriations from taxes or revenues." This commission, which was known as the "Budget Commission," after an exhaustive investigation, reported that it was expedient to adopt a segregated form of budget and prepared a scheme or "form of estimates and appropriation."

Beginning with Feb. 1, 1916, the beginning of the financial year, the Public Works Department, in conjunction with other departments, has been working under a segregated budget.

In Table III is a statement of the appropriation and expenditures of the Public Works Department, up to Jan. 1, 1917.

TABLE III.—APPROPRIATIONS AND EXPENDITURES—DEPARTMENT OF PUBLIC WORKS—TO JAN. 1, 1917.

Division & Services	Appropriation	Expenditures
Central Office	$74,725.00	$69,673.62
Bridge & Ferry Division		
Bridge Service	312,247.99	276,262.95
Ferry Service	298,115.75	278,266.55
Highway Division		
Lighting Service	779,431.36	765,197.67
Paving Service	981,594.54	914,169.91
Sanitary Service	963,488.76	910,282.13
Street Cleaning Service	677,178.76	636,014.85
Sewer Service	323,685.20	305,676.87
Water Service	939,700.16	849,671.24
Highways, making of	650,000.00	266,993.83
Repairing and Reconstructing	500,513.35	152,147.26

Never before in the history of Boston has the subject of streets been given more attention than during the past year. The condition of the streets has been criticised and in many instances the criticism has been just. Much of the unpleasant condition was due to the march of progress. It has been necessary to relieve the congestion in and around the business centers, and as it is not practicable to go overhead, the solution is underground—consequently, subways. Similar conditions were also created by the installation of the high pressure fire service, which, in turn, has been augmented by necessary changes in gas main locations and sewerage work to permit of the laying of the large pressure mains. But gradually the streets are beginning to resume their normal condition; the pavement has been relaid in some streets and new pavement laid in other streets. Much remains to be done, but a comprehensive plan has been adopted and in a few years conditions will have greatly changed for the better.

Smooth, noiseless and sanitary pavements are being laid where practicable. When Boylston St., from Tremont St. to Washington St., is completed, which will be early in the spring, the entire so-called "shopping district" of Boston will be paved with smooth pavements, a condition much appreciated by the general public.

One of the most noteworthy changes in the policy of constructing streets was the elimination of macadam roads. There are about 400 mi. of macadam in the city—almost two-thirds of its entire street mileage. However, this is a condition for which the Street Department is not responsible, as the Street Commissioners—of a separate department—give hearings preparatory to laying out streets and the abutters intimate, and very forcibly in many cases, that only inexpensive construction is wanted, and that, too, when only a part of the cost is borne by them. The result is a large area of temporary street surface which later on must be replaced by permanent pavement and the total cost of which must be borne by the Public Works Department. During the year 1916 not one yard of new macadam street surface was constructed. Following an order issued by the Mayor, all suburban streets that were formerly built with macadam, were this year, and will be in the future, built with a 4-in. concrete base and a 3-in. asphalt, bitulithic or Topeka top, in some instances with brick gutters.

As a result of the agitation concerning the method of paving Boston's streets, a committee was appointed by the Mayor, during the past year, consisting of James H. Sullivan, Division Engineer, Public Works Department; Hector J. Hughes, of Harvard University; Guy C. Emerson, Engineer of the Boston Finance Commission; John R. Rablin, Chief Engineer of the Metropolitan Park Commission, and Arthur W. Dean, Chief Engineer of the Massachusetts Highway Commission. This committee's report, which was accepted and put into practice, was as follows:

> For purposes of this report the streets have been divided into six classes, namely
>
> (1) Heavy Traffic Streets—That is, streets carrying a large volume of heavy trucking.
> (2) Main Arteries—That is, main radial highways leading to and from the city proper and carrying heavy traffic.
> (3) Retail Shopping and Office Building Districts.
> (4) Residential Districts (City Proper).
> (5) Residential Districts (Suburban).
> (6) Park Roads.
>
> The types of surfacing recommended for the various classes of streets are as follows:
>
> Class 1.—(Heavy traffic streets)—Granite blocks laid on Portland cement concrete base not less than six (6) inches in thickness, the joints to be filled with Portland cement grout; in the case of excessive grades, pitch to be substituted for grout in the upper inch or so of the joints in order to provide better foothold for horses.
>
> Class 2.—(Main arteries)—The same type of pavement as Class 1, with a few exceptions where the surroundings require a smoother and less noisy surface, such as wood blocks or the best grades of bituminous pavements.
>
> Class 3.—(Retail shopping and office building districts)—Treated wood block pavements; the best grades of bituminous pavements on a Portland-cement concrete base. At the present time the only wood recommended for wood block pavements is long-leaf yellow pine.
>
> Class 4.—(Residential districts in the city proper)—Treated wood block pavements, the best grade of bituminous pavements or Portland cement concrete pavements; the choice to be determined by the intensity and character of the traffic.
>
> Class 5.—(Suburb and residential districts)—Cheaper types of bituminous pavements, using old macadam surfaces for the base where suitable, or Portland cement concrete pavements.
>
> Class 6.—(Park roads carrying only pleasure traffic)—Bituminous pavements using old macadam for the base where suitable, or Portland cement concrete pavements.
>
> The committee deems it inadvisable and unnecessary to prepare new specifications for the pavement recommended in view of the fact that most excellent specifications have been carefully prepared after thorough discussion by experts, and adopted by organizations of high standing.
>
> It is recommended that paving work, done by the City and the provisions and requirements of any guarantee relating to such work shall conform substantially to specifications adopted by the American Society of Municipal Improvements, for granite block, wood block and bituminous pavements; for Portland cement concrete surfaces the work should conform substantially to the standard specifications of the American Concrete Institute.

Another innovation this year was the advertising and awarding of contracts in groups. It had been the custom in the past to award one street, or at the most three streets, at one time. It was argued that if a large number of streets, embracing a large area, were advertised and awarded to one contractor, the city would benefit. Following an appropriation of $500,513.35 for the purpose of reconstructing and repairing streets, the city at once advertised and awarded to the lowest bidder, Bernard E. Grant, a group of 18 principal streets, with an estimated yardage of 88,000 and an estimated cost of $358,000. A second group of 11 streets was awarded to the lowest bidder, Warren Brothers Company, with an estimated yardage of 35,000 and an estimated cost of $81,000. Work has been going on under these contracts, and the following streets have been completed: Batterymarch St., Devonshire St., School St., Columbia Road and Albany St., between Dover and Malden Sts., under the Grant contract, and Chandler St., Dearborn St., North Anderson St., Parkman St. and West Canton St., under the Warren Brothers contract.

Under this same appropriation a contract was awarded to repair all asphalt and bitulithic pavements on which the

TREMONT ST. AT PARK ST.—FIRST TREATED WOOD-BLOCK PAVEMENT LAID IN BOSTON.

COLUMBIA ROAD, BOSTON—BITULITHIC PAVEMENT ON OLD MACADAM BASE

maintenance guarantee had expired. This contract was awarded to the Central Construction Co., the lowest bidder. At the time of awarding this contract there were 413,388 sq. yds. out of guarantee.

Before beginning work on any street, all corporations having anything to do with the streets, as regard underground pipes, conduits, etc., were notified of the intention of the city to repave the streets and were ordered to finish at once whatever work they might have to do preparatory to the laying of the pavement, as no openings would be permitted for a period of two years after the completion of the work. Monthly conferences are being held by the officials of the city and the representatives of all corporations having anything to do with the streets, for the purpose of reducing to a minimum the openings of pavements.

Under the appropriation for "making of highways" which is for the construction of new streets, the same policy of grouping streets was observed and contracts were awarded for the construction of 8, 17, 19 and 14, respectively.

On account of the anticipated repairing of downtown streets, the Sewer Service was compelled to rebuild the old sewers in Canal, Sudbury, Cross, Fulton, Barrett and Clinton Sts. New tide gates have been built and the construction of the main channel of Stony Brook has been completed to about 100 ft. beyond Washington St.

The Paving Service forces have built a part of Beacon St., Brighton, at the Newton line, with cement concrete, and also portions of Charles St., Dorchester and Parkton Road, Roxbury. These are the first concrete roads built in

VIEW ON A PORTION OF CHARLES ST., BOSTON, MASS.—GRANITE BLOCK PAVEMENT WITH PITCH AND PEBBLE JOINTS; CONCRETE FOUNDATION

VIEW ON LONGWOOD AVE., ROXBURY—VITRIFIED BRICK PAVEMENT

BEACON ST. AT CHESTNUT HILL DRIVEWAY—CEMENT CONCRETE PAVEMENT—TAR-MACADAM SHOULDER

this city and it is the intention of the department to lay many miles of this form of pavement during the coming year. Table IV shows the amount of work done both by contract and by department forces during the past year.

One of the most notable achievements was the awarding of the contract and the starting of work on the so-called "Strandway Improvement." In 1912 the General Court of Massachusetts provided for an investigation of the advisability and cost of improving the shores of Dorchester Bay, known as Old Harbor. This great movement passed through various stages and it culminated this year in the awarding of the contract, the estimated cost of which is upwards of $800,000. By bringing in the water of the harbor, dredging a large area of flats, extending the overflow from various sewers, and by the reclamation of the adjoining shores, this immense tract of water territory will be recovered and converted into a vast playground and health resort. A bathing beach nearly two miles long will result and with bath houses, shelters, band stands, etc., it will compare favorably with Revere Beach, Nantasket, and other resorts. Back from the beach and encircled by a magnificent system of boulevards, walks and plantations, a great field of over 50 acres will be completely fitted up with all manner of athletic apparatus. The entire project will be completed during the coming year.

On Feb. 1, 1916, there were 852.3 mi. of supply and distributing water mains in the city, with 9,358 fire hydrants. There were 62,379,200,000 gal. of water stored in the ten reservoirs, whose total capacity is 80,908,900,000. The daily average amount of water used in 1915 was 104 gal. per capita.

CAMBRIDGE BRIDGE, CONNECTING CAMBRIDGE AND BOSTON—BUILT AT A COST OF ABOUT $2,500,000—OPENED IN 1907—LENGTH, NEARLY 1½ MI.

The number of lamps in the city is as follows: 5,099 magnetite arc lamps, 23 thoran, 3,180 tungsten lamps, 40 c. p.; 1,264, 60 c. p. There are 9,857 single mantle gas lamps, 146 single gas fire alarm lamps and 70 double mantle gas lamps. Under the 10-year electric lighting contract, expiring in 1924, the price of the magnetite arc lamps is $87.53 each per year, instead of $103.53 as formerly. The price per year of single mantle, 60 c. p., gas lamps is $21.00, of 40 c. p. tungsten incandescent, $18.33; 60 c. p. is $21.13. A so-called "White Way" was installed this year on Canal St., one of the main arteries to the North Station.

Under the direction of the Bridge Service, foot bridges have been constructed at various points throughout the city, both under and over railroad tracks, thereby eliminating the possibility of accidents to pedestrians crossing the tracks. The bridge at Spring St., West Roxbury, has been completed, making a 55-ft. roadway in place of the former roadway of 25 ft. Malden Bridge across the Mystic River is being rebuilt.

TABLE IV.—STREET WORK DONE DURING 1916, BOSTON, MASSACHUSETTS.

Character of Work	Sq. yds.
Work Done by Contract	
Asphalt surface and binder laid, on concrete base	59,480
Bitulithic Pavement laid on concrete base	4,640
Bituminous Macadam laid	280
Brick Block Gutters laid, on concrete base	2,175
Granite Block laid, cement grout joints, including concrete base	24,760
Hassam Block Pavement laid, concrete base	5,120
Wood Block Pavement laid, on concrete base	1,920
Artificial stone sidewalks laid	26,010
Brick sidewalks laid	11,740
Work Done by Department Force	
Macadam surface placed (Asphalt Binder)	34,225
Macadam surface placed (Tar Binder)	84,693
Macadam surface placed (Water Binder)	26,516
Concrete pavement laid	12,950
Granite Block laid, cement grout joints	17,688
Wood Block Pavement laid	72
Flagging Crosswalks laid	403
Brick Sidewalks laid	3,235
Macadam Surface patched (Tar & Asphalt Binder)	72,873

The system of refuse collection and disposal in operation in the city is designed to eliminate all the objectionable features of the former system and provides for the recovering of by-products. Its essential features are a system of waterfront and inland refuse collection stations, a fleet of scows of special design for the distribution at sea of classified refuse, receiving and destruction station located in tide-water flats valuable for reclamation by filling with ashes, and a garbage reduction plant with a destructive installation for miscellaneous refuse, located on an island in Boston Harbor, about 4 mi. from the heart of the city. The city collects all refuse in three divisions, garbage, clean ashes and remainder. The first and last named classes are transported by scows to Spectacle Island, where the Boston Development and Sanitary Co. has built a combined reduction and destructor plant. The ashes are towed from the Fort Hill wharf and Commercial Point receiving station of Orient Heights, East Boston, where the company has built a combined screening, paper handling and destructor plant. A paper handling and destructor plant is located on Southampton St., in the vicinity of Andrew Square, and ashes are handled here and used in filling in tide flats.

In conclusion it might be said that Boston is a peculiar city in the matter of vehicular traffic. In the city proper, in the suburban districts—in fact, in any direction one goes—Boston supports a greater team traffic than most cities. From all points of the compass a vast number of vehicles comes and goes, and with the advent of the motor truck, the more distant towns and cities, such as Worcester, Lowell and Brockton, now send their complements, where before the business was handled by the railroad and express companies. It becomes necessary then for Boston not only to provide for the conditions of today, but also for the future, as no one can predict what traction evolution will demonstrate in the next decade.

Resurfacing Old Macadam Roadways With Shale Cubes

By J. Y. McCLINTOCK*

Since 1908 we have demonstrated in Monroe County the possibility of resurfacing old macadam roads in such a way as to meet the requirements of high speed motor traffic as well as horse-drawn traffic. During that time we have used some ten million small cubes of various materials, some 2 in. square and some 2¼ in. square. The best results have been obtained with cubes made of vitrified shale similar to that used for the manufacture of vitrified brick paving blocks.

Besides being used for resurfacing old water bound macadam roads after shaping them up with local gravel, the cubes have been used for resurfacing old tar penetration macadam roads shaped up with a thin layer of sand. The cubes have also been laid on new gravel foundations, on broken stone foundations filled with sand, on sand cushions on concrete bridge floors, and on sand cushions on broken furnace slag foundations.

The cubes are made in an ordinary screw brick machine having wire grill inserted in outlet of cylinder. After being dried in an ordinary dry kiln, the cubes are burned in a down draught kiln about 70 ft. long and 20 ft. wide, divided into two parts by a flue running through the center. The cubes are shoveled into this kiln with no more care than would be taken with broken stone. By properly manipulating the dampers it is possible to burn the cubes very uniformly, and it is also a very simple matter to cull the cubes by color. After burning, the cubes absorb about 3 per cent. of their weight of water.

The usual practice in resurfacing with cubes is to make the surface paved with them of a somewhat less width than the supporting base. Broken stone or coarse gravel shoulders are then built out from the edges of the cube pavement to the edges of the base. This permits traffic to pass from the paved area to the earth shoulders with less tendency to break down the pavement at the edges. The cubes weigh about one pound each and are laid close together, about 225 being required to cover 1 sq. yd. of surface. The joints between the cubes are filled with any fine local material, such as sand or loam.

Some of the best pavements of this kind have been laid by town superintendents with unskilled local labor. During the past year an especially good pavement of this kind has been built by the town superintendent of Brighton. This road is about ¼ mi. long and consists of a 12-ft. pavement with broken stone shoulders on a 16-ft. broken limestone base 5 in. in thickness after rolling. This road was built at a cost of $9,900 per mi., including the broken stone foundation. A gravel road ¼ mi. long was built during 1916 by the town superintendent of Irondequoit and paved for a width of 12 ft. in the center with cubes, the shoulders being of coarse gravel. The cost of this road was $6,100 per mi., including the shaping and the gravel foundation. There is also under construction in the town of Webster about 2½ mi. of road built as follows: The road is shaped up to a width of 28 ft. between gutters and there is placed in the center a foundation of local field stone consisting of slabs of rotten sandstone thoroughly rolled to a depth of 8 in. in the center and 4 in. at the edges. In the center is placed a cube pavement 13½ ft. wide with broken stone shoulders all on a clay bottom. In the town of Brighton there is under construction a

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*County Superintendent, Monroe County, Rochester, N. Y.

2½-mi. road of a somewhat similar construction except that the foundation consists of a 5-in. course of broken iron-furnace slag laid to a width of 16 ft. The cube pavement in this case is 12 ft. wide and has broken slag shoulders.

The State Highway Department has decided to improve two sections of county highway by widening the existing 10-ft. stone roads to 16 ft. and laying 10-ft. cube pavements with broken stone shoulders.

The cubes have been manufactured and sold for $2 per thousand with a margin of profit. We are advised by some of the leading clay experts that it would be possible to arrange a brick yard with tunnel kilns and machine carriers so as to very materially reduce the cost of manufacture. We have reason to believe that if a plant were established at the Elmira Reformatory or at Sing Sing, the state could manufacture the cubes by prison labor at a cost as low as $1 per thousand. From these points it would be possible to deliver to a large portion of the road mileage in New York State for about 50 ct. per thousand. On this basis, assuming the length of haul from the railway or canal to the highway as 2 mi., the average cost of the cubes, delivered on the road, would be about $1.95 per thousand. Our experience demonstrates that the cubes can be laid and the joints filled at a cost of about 10 ct. per sq. yd. Since, as previously stated, about 225 cubes are required to cover 1 sq. yd. this would bring the cost of the cube pavement, in place and filled, perhaps as low as 55 ct. per sq. yd.

CUBE PAVEMENT ON SCOTTSVILLE ROAD, MONROE COUNTY, N. Y.—PAVEMENT UNINJURED BY WATER

Assuming that these cubes were used on the 6,000 mi. of state and county highways already built, and adding, say 20% for contractor's profit, the work could be done for between $5,000 and $6,000 per mi. The pavement could also be used upon the 50,000 mi. of town highways not included in the state and county systems. On these the stone foundations might be 12 ft. wide and the cube pavements 9 ft. wide. Such work could be done by town superintendents and the cost of surfacing reduced to $3,000 per mi.

The cube pavement supports traffic, has an attractive appearance, and affords a surface which is not slippery. It has been found satisfactory in Monroe County and should also prove satisfactory in other counties in New York State and also in other states.

Report on Connecticut Road Work

The biennial report of State Highway Commissioner Charles J. Bennett for the two years ending Sept. 30, 1916, gives the net expenditures for road work in Connecticut for the year 1914-1915 as $1,871,131.16, and for the year 1915-1916 as $1,756,805.44, and the total mileage of roads built during the two years, 136.69 mi. This includes roads of all types, and makes the total net mileage of highways in the state with state aid and trunk lines, about 1,425.77 mi.

Commissioner Bennett reports satisfactory results from the labor of inmates of the state reformatory, and says that the quality of the work performed by them was equal to that of the ordinary laborer.

The gross expenditures for trunk line bridges in the state amounted to $530,000 for the two-year period. The expenditures for repairs and maintenance which include straight maintenance and replacements, with all refunds deducted, were as follows: 1914-1915, $879,936.44; 1915-1916, $981,608.73.

It is stated in the report that the amounts received from automobile fees reached $730,000, and that if the number of motor vehicles increased for the next two or three years at the same rate as in the past, the state road maintenance would not be a direct charge upon the funds of the State Highway Department secured from state appropriations.

WESTFALL ROAD, BRIGHTON, N. Y.—CUBE PAVEMENT 12 FT. WIDE ON 14-FT. MACADAM BASE

Connecticut's yearly apportionments of federal government appropriations are as follows: 1917, $31,090.44; 1918, $62,180.88; 1919, $93,271.32; 1920, $124,361.76; 1921, $155,452.20. Commissioner Bennett recommends the passage of an act assenting to the government's rules and providing state appropriations sufficient to meet those of the government.

In recommending the use of cheap material in road work until such time as the best type of materials for a particular locality can be determined, the commissioner says that the main highways will eventually have to be replaced with cement concrete or bituminous pavement with concrete base, at an expense per year of approximately $500,000 for at least seven years. In referring to dangerous conditions on trunk line highways, a special appropriation is urged for the elimination of grade crossings. The building of roads to withstand increasing heavy motor traffic and restrictions as to tires, springs, the amount of unsprung weight, the speed of travel, and roads upon which heavy motor traffic may be permitted are among the recommendations contained in the report.

The Central Minnesota Auxiliary National Parks Highway Association, at a recent meeting, laid out a new state highway route traversing the state in a northeasterly direction by way of St. Cloud, St. Joseph, Avon, Albany, Freeport, Melrose, Sauk Center, West Union, Osakis, Alexandria, Garfield, Brandon, Evansville, Melby, Ashby, Dalton, Fergus Falls, Elizabeth, Rothsay, Barnesville and Moorhead. There is said to have been some opposition to the route by clubs that favor what is known as the "Yellow Trail Route." It is expected that funds will be asked from the state for the improvement of the road.

Motor Truck Operation in Road and Street Work

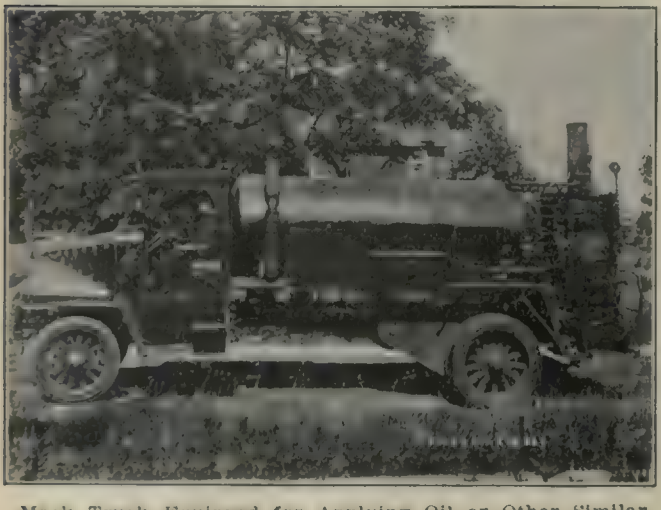
By GEORGE H. PRIDE[*]

In the last two years the use of motor trucks by road contractors has become quite general in certain sections of the country.

There are used, generally speaking, two different types of motor trucks, the platform truck and the dump truck. The number of platform trucks used is relatively quite small and they are usually of low tonnage capacity, their main purpose being to transport general utility supplies, commissary stores, iron pipe for culverts, stone curbing, etc., but the number of dump trucks used is very large owing to the fact that the bulk of material used in road work is of a character which requires a dumping body to handle it expeditiously.

Kelly 3½-ton Truck Transporting Road Materials and Equipment

White Truck In Use for Hauling a Road Scarifier in City Highway Work.



Mack Truck Equipped for Applying Oil or Other Similar Materials in Road and Street Work.

Autocar Employed in City Work to Haul Snow From Street to Dump

VIEWS SHOWING SOME OF THE VARIED USES TO WHICH MOTOR TRUCKS ARE PUT IN HIGHWAY WORK IN COUNTRY AND CITY

Motor dump trucks may be classified in two ways, first by the method of dumping, and, second, by their tonnage capacity.

The dumping devices used for discharging the loads carried in these motor dump trucks are of two varieties, hand operated and mechanically operated. The advantage of the hand operated dumping device is its initial cheapness and simplicity of construction, and the chief disadvantage is its slowness of operation. When mechanical dumping devices were initially put on the market it was so difficult to keep them in repair that the hand dumping device was more advantageous, even though it slowed up the operation of the truck, but with the improvements made in the past few years, the writer is very strongly of the conclusion that the quick-acting, mechanically operated dumping devices are far superior in every way to the old-fashioned hand dumping devices. There seem to have developed two types of mechanical dumping devices, those hydraulically operated and those operating directly through gears and chains. The hydraulic hoist seems to be the most popular up to the present time, although it is open to all the objections to a hydraulic jack and some additional ones. For some reason or other the direct application of power through gears, chains and pulleys does not seem to have been developed to the same degree for dumping purposes as have hydraulic dumping devices.

In this connection it must be remembered that when the mechanical dumping devices are not working the trucks are almost as useless as if the motors were not working; so that great care must be exercised in using the proper form of mechanical hoist and in seeing that it is sufficiently sturdy to withstand the excessive stresses and strains which will be put upon it, and finally that it is properly and accurately installed on the truck. For this reason the writer believes that the hand operated dumping devices still have a field in sections remote from service stations, or in regions lacking facilities for making machine shop repairs.

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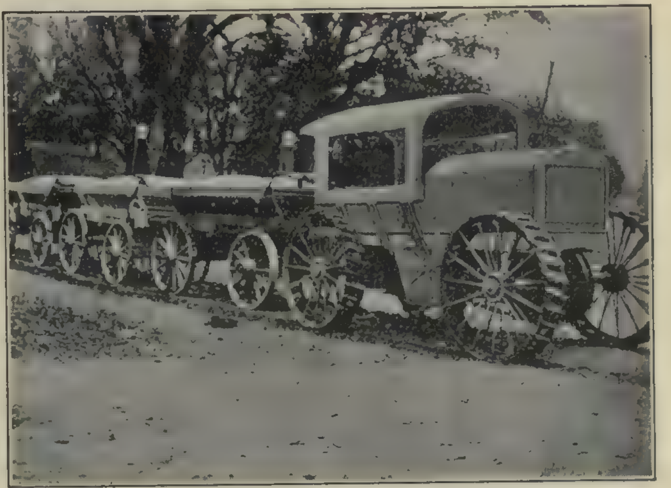
[*] Heavy Haulage Co., New York, N. Y.

Knox Tractor With Trailer

Gramm-Bernstein 3½-ton Truck

Sterling 7-ton Truck


Lenox "American" Tractor With Trailer

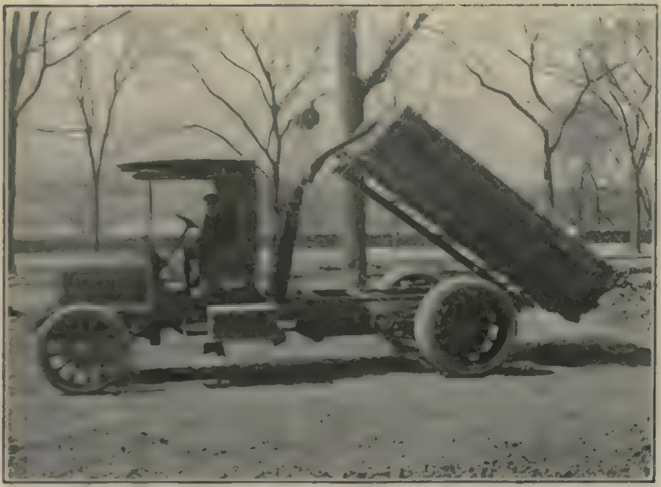
Jeffery "Quad" With Trailer

G M C Truck

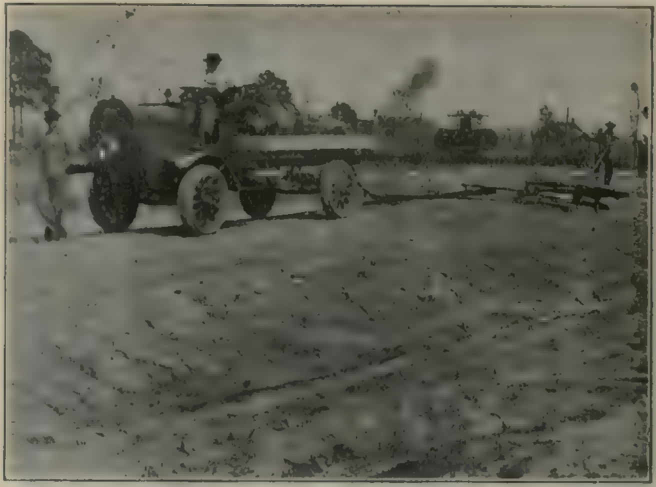
MOTOR TRUCKS AND TRACTORS OF VARIOUS MAKES AND TYPES USED FOR HAULING MATERIALS IN ROAD AND STREET WORK

The writer has observed the operation of a fleet of motor trucks over a period of four years and during this time has noticed that more delays have occurred owing to the defects in the mechanical dumping devices than on account of the inability of the trucks to run.

When motor trucks were first used for road building there was a wide difference of opinion as to the proper tonnage to use for this work. The writer thinks that it is



SAURER TRUCK USED BY CONTRACTOR IN CITY STREET WORK



DUPLEX TRUCK HAULING ROAD DRAGS IN COUNTRY ROAD WORK

now pretty generally the opinion that the 5-ton motor trucks are the most advantageous size from the standpoints of efficiency and economy. While it is true that a 5-ton truck, which, when loaded, will weigh gross about 12 tons, is an exceedingly heavy unit to work over a road in process of construction, actual experience indicates that this size unit in good weather will transport the required amount of material over the partially finished subgrade with much less cutting up and damage than would result by the use of smaller sized units which would require a proportionately greater number of trips. This is brought out very clearly if only by the fact that a 5-ton truck carrying 60 tons of broken stone over the subgrade would only have to make 12 trips, as against 20 trips of a 3-ton truck, which would mean that in the case of the 5-ton truck there would be only 12 turning operations on the subgrade as against 20 in the case of the 3-ton truck, and the disturbance of subgrade is most acute at points when trucks are turned in order to head them back empty for another load. In bad weather it is exceedingly inadvisable to attempt to operate trucks of any size on a subgrade; it not only destroys the subgrade, but it also destroys the trucks. The results accomplished under these last conditions are unquestionably detrimental rather than beneficial.

It must be borne in mind that no matter how efficient the truck itself may be or how ideal the weather conditions may be, a motor truck cannot operate successfully unless it can be promptly loaded. This is just as important as being able to unload it rapidly, and as it is generally recognized that it is economy to install mechanical dumping devices on motor trucks it should also be apparent that rapid mechanical devices for loading motor trucks are equally essential. The writer has had experience with several different varieties of loaders, but by far the most efficient up to the present time is the method of bin loading; that is to say, there should be constructed bins having a capacity of at least six loads for each truck operating from the bin. It is a general habit of road contractors to make their loading bins too small, with the idea of saving a little on the cost of lumber, but it must be remembered that the conveyor machinery which is used to load these bins is usually subject to many vicissitudes and breakdowns, and if the bin is not sufficiently large to hold enough material to bridge the gaps caused by these breakdowns it means that the operation of the motor trucks will be spasmodic and exceedingly expensive. Mechanical loaders which work by a system of bucket conveyors and discharge directly from the ground into the trucks have appeared in increasing numbers in the last two years, but owing to their lack of development up to the present time, the writer has been unable to find any which competed with the form of bin loading. Undoubtedly, the capacity of these mechanical loading devices will be increased to the point where they can so compete, but, unfortunately, this degree of efficiency does not seem to have been reached as yet. The only advantage the writer has been able to observe of these direct mechanical loaders up to the present time is that they will load a motor truck in about the

NETCO TRUCK FITTED WITH TANK AND DISTRIBUTING MECHANISM FOR ROAD OILING

HURLBURT CHASSIS AND TRAILER BUILT FOR USE IN HIGHWAY WORK same time as an efficient gang of eight shovelers will load it, while this mechanical loader will only require the services of three men. While this is an economy from a labor standpoint, it is nevertheless so slow that the efficiency of the motor truck is cut very materially and, in the writer's opinion, if such a device for loading is used motor trucks can with difficulty be operated economically on a haul of less than 2½ mi., one way.

Intelligence in the operation of any mechanical equipment is always necessary, but intelligent drivers of motor trucks on road work are not only exceedingly valuable, but absolutely necessary to the success of the operation. This point cannot be too strongly emphasized and owners of motor trucks who seek to make their operation economical by engaging cheap labor for this purpose are making a grave mistake.

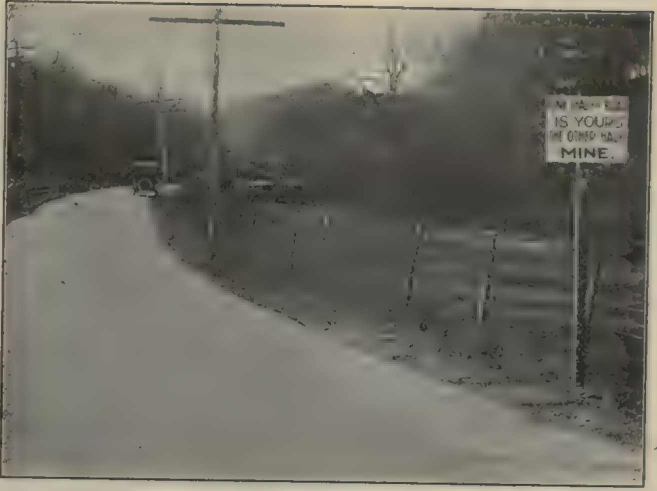
There have been two methods employed in connection with using motor trucks on road work. By one, trucks are rented, as required, from concerns owning and operating them; by the other the contractor owns and operates his own motor trucks. The first method has become increasingly popular in the last two years and bids fair to become the general practice for the same reason contractors usually hire the bulk of their horses. A contract may require at certain periods the service of from 5 to 15 motor trucks and there will frequently be long periods when no trucks are required. The contractor cannot afford to have a large investment in motor trucks lying idle for long periods, yet he must have a sufficient amount of equipment when required to work the job at its maximum. In addition, it is now a well known fact that the motor truck costs a considerable sum of money every day it lies idle and as it is almost always possible at the present time to obtain the services of such vehicles when required, at a very reasonable figure, the popularity of this custom is easily understood.

In conclusion the writer wishes to say that if the operation is intelligently handled and the average haul is in excess of 1½ mi., under normal conditions the operation of the motor truck on road work is not only possible, but usually desirable. In some instances, under unusual conditions, motor trucks can be operated profitably on shorter hauls in road work, with the additional factor that if motor trucks are used they tend to speed up the entire operation as nothing else seems to have been able to do up to the present time.

Warning Signs on a North Carolina Road

A bituminous concrete road between Asheville and Weaverville is not only the first hard-surfaced road built in Buncombe County, North Carolina, but is noteworthy on account of the unusual and significant character of the warning signs which have been erected along it. The road is 10 mi. long and forms a link in the so-called Southern National Highway. The signs, which are shown in the accompanying illustrations were designed by Charles N. Neal, Road Engineer of Buncombe County, whose headquarters are at Asheville, and they were erected at the suggestion of the Asheville Motor Club.

The Asheville-Weaverville Road, as it is known, was built on an old worn-out macadam road, except in a few places where the road was changed to eliminate heavy grades. The old macadam was scarified, and on top of it was placed 4 in. of crushed stone which was rolled down to a thickness of 2½ or 3 in. On this foundation a layer of asphaltic concrete was put down to a depth of 3½ in. which was reduced to 2¾ in. by rolling. The stone used in the mixture ranged in size from ⅜ to 1½ in. and was heated to about 300° F., 19 gal. of hot Mexican asphalt being used to 1 cu. yd. of stone. The mixing was done in a ⅛-yd. mixer. After the foundation layer had been thoroughly rolled, the seal coat was applied. This consisted of from ¾ to 1 gal. of hot asphalt per sq. yd., upon which was sprinkled a layer of chipped stone, and the road again rolled. The roadway is paved for a width of 16 ft.



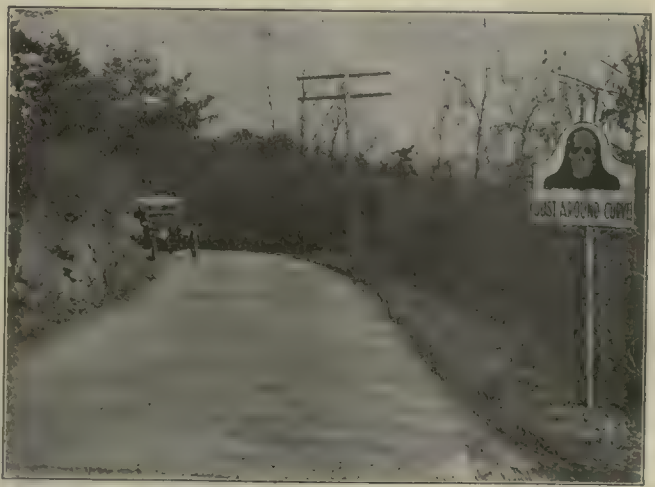
UNIQUE SIGN ON THE ROAD BETWEEN ASHEVILLE AND WEAVERVILLE, N. C.

The foundation was prepared by the county with its convict force under the supervision of the County Engineer and the Board of County Supervisors, at a cost of 20 ct. per sq. yd. The bituminous concrete surface was laid by the Crinkley Construction Co., of Harriman, Tenn., at a cost of 72 ct. per sq. yd. The county keeps one man employed on the road constantly, with cement, chipped stone and asphalt, to make repairs where and whenever necessary.

Road School at Purdue University

The short course in highway engineering which is given annually under the auspices of the School of Civil Engineering, Purdue University, was held at LaFayette, Ind., Jan. 16 to 18. The annual meeting of the Indiana County Road Superintendents Association was held in connection with the road school. There was an attendance of more than 100 road officials from various parts of the state.

Practically all types of roads were considered, the greater part of the time being devoted to maintenance problems. One session of the course was held in the road testing laboratory, with all of the road testing machines in operation, and among other tests made for the benefit of those attending the school, a slab of the new type of monolithic brick pavement was made up and tested.



UNUSUAL WARNING SIGN ON THE ASHEVILLE-WEAVERVILLE ROAD, BUNCOMBE COUNTY, N. C.

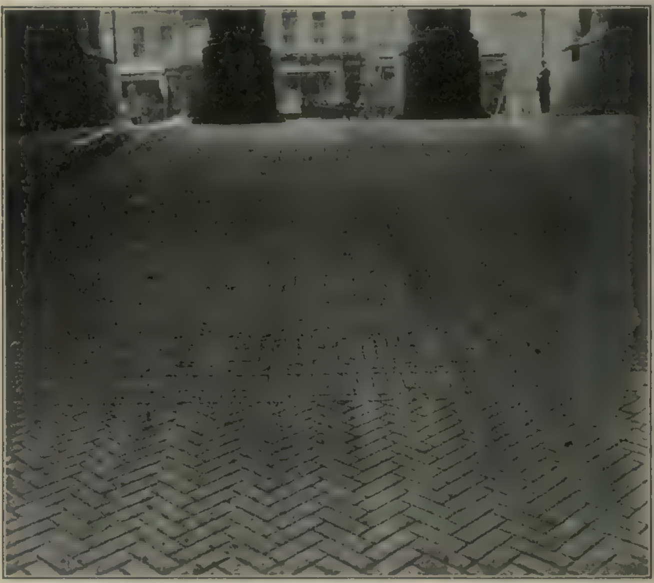
Brick Pavements on Green Concrete Foundations and Sand-Cement Superfoundations[*]

By WM. C. PERKINS[†]

During the past two years the method of constructing brick streets and highways has radically changed. New methods of construction have materially reduced the cost of brick pavements and at the same time have greatly improved the pavements themselves by giving them greater rigidity and durability.

Vitrified brick as a paving material has been used in this country for nearly 50 years, and has always proven a dependable material. Many cities have brick pavements 25 to 30 years old which are now in good condition and rendering good service. On the other hand, brick pavements have been constructed, which, in a short period, have shown serious defects. These defects which occur in the brick wearing surface have been carefully studied by paving engineers, and a new type of construction evolved—one which eliminates the idea of the necessity of a resilient bed or cushion beween the brick wearing surface and the foundation and substitutes the laying of the brick directly upon a non-shifting, non-shrinking, rigid foundation, thus making the wearing surface and foundation practically a monolith.

BAY STREET, JACKSONVILLE, FLA.—CEMENT-SAND TYPE BRICK PAVEMENT IN RAILWAY AREA.



DRIVEWAY AT THE PENNSYLVANIA TERMINAL, NEW YORK CITY—BRICK LAID ON CEMENT-SAND BED.

Two methods of construction are being used: (1) The laying of the brick directly in the green, or newly laid, concrete, commonly called "the monolithic construction," and (2) The laying of the brick on a superfoundation of cement-sand, the cement and sand being throughly mixed dry and spread on the prepared foundation, the bricks after being rolled, being well wet down, the cement and sand thus forming a mortar bed which unites the wearing surface and the foundation. This method is commonly called "the semi-monolithic construction."

Each type has its place and the results obtained in practice are practically the same. The monolithic type is generally used in the construction of roads and streets whose width does not exceed 24 ft., and where the grades and cross section are uniform. There are instances, however, when it has been used on wider streets with success. The semi-monolithic type is the general method used for city streets, especially if there are many intersections or much change in cross section. Sometimes the two types are combined, a layer of cement-sand being placed on the green concrete, or on the concrete foundation before it has well set up.

From a theoretical viewpoint the laying of the brick directly in the green concrete should give the truest monolith; but the results obtained with the cement-sand superfoundation have proven that for all practical purpose as strong and rigid a pavement is obtained with this type. Therefore, the engineer in preparing his plans and specifications should be governed by local conditions as to which type to use, being assured that the essential feature of each type is a rigid beam from wearing surface to subgrade.

Since the advent of the monolithic and semi-monolithic construction there is a decided tendency among paving engineers to reduce the depth of the brick from 4 in. to 3 in. No brick pavement has ever failed by the actual wearing away of the brick wearing surface. Why therefore, use a brick 4 in. in depth if it is possible to bind the wearing surface and foundation together?

We certainly have a stronger pavement with bricks laid as a monolith than laid with a sand cushion. Assuming a grouted brick pavement as a beam to hold the weight of traffic or the heavage of frost in these northern latitudes and consider the old type of construction—a 4-in. brick laid on a 1½-in. sand cushion on a 5-in. concrete foundation.

Fig. 1 is a comparison of the old type of construction and the new. In the old we have two beams acting independently, the sand cushion having no bonding strength, and, as the strength of beams varies as the square of their depth, the comparative strength of this type is 16 for the brick and 25 for the concrete or a total of 41.

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[*] Extracts from a paper entitled, "Recent Developments in Details of Construction of Brick Pavements on Green Concrete Foundations and Sand-Cement Superfoundations," presented by Mr. Perkins at the meeting of Section D, Engineering, of the American Association for the Advancement of Science, at New York, N. Y., Dec. 28, 1916. The portions of the paper omitted deal with the details of the methods of construction of the two types of pavements in the laying, rolling and grouting of the brick. These points have been covered in various other articles especially "Methods of Brick Pavement Construction," "Good Roads," February 5, 1916, page 55. They are also covered in the standard specifications of the National Paving Brick Manufacturers' Association. There is also omitted the latter part of the paper which consists of a general discussion of the uses of the monolithic and semi-monolithic types of brick pavement.

[†] Chief Engineer, Dunn Wire-Cut Lug Brick Co., Conneaut, Ohio.

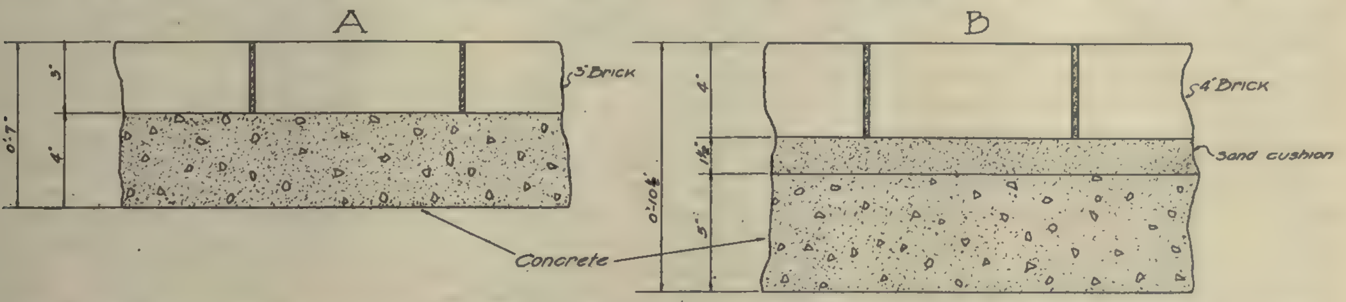

FIG. 1.—"A" IS A SECTION OF BRICK PAVEMENT OF THE MONOLITHIC TYPE; "B" IS A SECTION OF THE SAND CUSHION TYPE.

Now, consider a 3-in. brick pavement laid as a monolith in a 4-in. concrete foundation. [See "A."] In this type of construction the bricks are well bonded together and also bonded to the foundation and we practically have a 7-in. beam which has a comparative beam strength of 49. Therefore, the monolithic type saves 1 in. of foundation and 1 in. of brick surfacing and we have a relatively stronger pavement than with the sand cushion. This opens up to the paving engineer the economic design of pavements.

If a 3-in. brick, laid directly in green concrete, or on a cement-sand superfoundation, will give as durable a wearing surface as a 4-in. brick (we would not advise the use of a 3-in. brick on a plain sand cushion), there would be considerable saving in the cost of brick paving, especially in districts at a distance from the brick plants. The paving engineer in preparing his estimates should investigate the saving in 1 in. of brick as compared with 1 in. of the prepared foundation, and prepare his plans and cross section of pavement accordingly.

In the manufacture of 3-in. paving brick there is a little saving in cost at the plant; the main saving, however, is in the freight charges. A thousand 3-in. paving brick weigh about 7,500 lb., which is a saving in weight of approximately 2,500 lb. over that of a 4-in. brick. This would mean on a shipment of brick to New York City from eastern Ohio district a saving of about 16 ct. per sq. yd. of brick surface. To the contractor there is a considerable saving in the use of a 3-in. paving brick. He could haul one-fourth more brick per load; the manipulation of handling and laying would be faster; they would require one-fourth less grout or bonding material and also require less excavation. Many engineers are taking advantage of these savings and there was an increasing demand for 3-in. brick during the year 1916.

In constructing monolithic and semi-monolithic roads and pavements the personal equation of the engineer or inspector in charge is an important factor; no detail is too unimportant to require his careful attention.

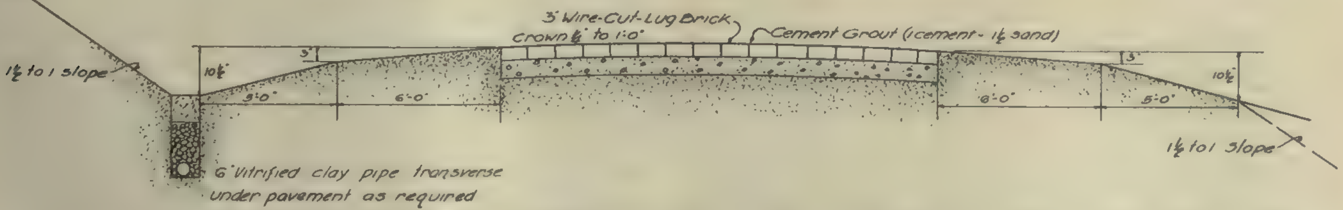

FIG. 2.—DETAIL CROSS SECTION OF A CEMENT GROUTED BRICK PAVEMENT OF THE MONOLITHIC TYPE.

The actuual methods of construction are in formative state. There are isolated instances of pavements in which brick have been laid in green concrete or a cement-sand bed, but the laying of brick in large quantities by these methods is a development of the last two years. In fact the first piece of monolithic roadway was laid in Edgar County, Illinois, in 1915. The inclined approaches to the Pennsylvaina Railroad Terminal at 31st and 33d Sts., New York City, were laid in 1910, the brick being 2½ in. in depth and laid in a cement-sand bed (mixed one of cement to three of sand) and the joints well grouted. Jacksonville, Florida, in 1912, also used a cement-sand bed under bricks in the car track area on Bay St.

The monolithic brick roadway consists of a concrete base of a thickness to satisfy local conditions as to traffic and subsoil, and a grouted brick wearing surface. [See Fig. 2 showing section of monolithic roadway.]

In the preparation of the concrete foundation in order to obtain the best results, the cement and the fine and the coarse aggregate in proper proportions should be thoroughly mixed in a batch mixer and a regulated amount of water added so as to produce a "quaking" concrete.

Care must be taken to avoid extremes: the concrete should not be too wet or to dry, and the engineer in charge should endeavor to obtain a uniform consistency of mixture.

Every precaution should be used to obtain a concrete foundation of uniform density. We would, therefore advise the use of a movable spout or chute for depositing the concrete. If a boom and bucket are used there is a tendency for the concrete, to be dense and compact where dumped by the bucket while that which is shoveled or raked into position has a tendency to be loose and therefore more susceptible to compression by the roller when the brick wearing surface is rolled, result being a wavy brick surface. Therefore, the aim of the engineer should be to so mix and deposit the concrete as to obtain a concrete foundation of uniform consistency and uniform density in order to insure a uniform compression by the roller and consequently a smooth, true surface on the brick roadway.

The concrete after being deposited should be shaped roughly to the proper contour and cross section with a shaping template and then cut with a steel cutting template to a cross section ⅜ in. higher than the required thickness of foundation. It should then be tamped carefully to exact cross section with a striking or patting template, care being taken that this tamping template be of sufficient weight so that its center will not vibrate more than the sides. This tamping aids in giving uniform compactness to the mass and also brings a film of concrete (cement-sand) to the surface which facilitates bonding.

On the monolithic roads of Illinois, where gravel is generally used in the concrete, the operation of shaping the foundation is done with a steel multiple template, consisting of two cutting or shaping templates, the rear one being ⅛ in higher than the front one, and mounted on a rigid frame equipped with rollers which move on steel side forms set to line and grade. The space between the two templates is kept filled with a dry mixture of cement and sand, and as the front template cuts the concrete to the proper cross section, the rear template spreads a thin film of cement-sand over the cut concrete surface, filling all voids and smoothing up the surface. This method eliminates the human element of the final tamping and good results are obtained, especially when gravel concrete is used.

The surface of the concrete foundation should be as true to grade and cross section as it is possible to make it, as upon this depends the smoothness of the finished roadway.

The laying of the brick should follow closely the laying of the concrete foundation, care being taken that the bricks are in place before the concrete has obtained its initial set. * * * * *

In discussing the details of construction of the cement-sand superfoundation or the semi-monolithic type [See Fig. 3 showing section of semi-monolithic street] many of the steps are the same as discussed under the monolithic type. The same care must be taken in preparing the subgrade, small drain pipes being used under each curb if the soil conditions are treacherous.

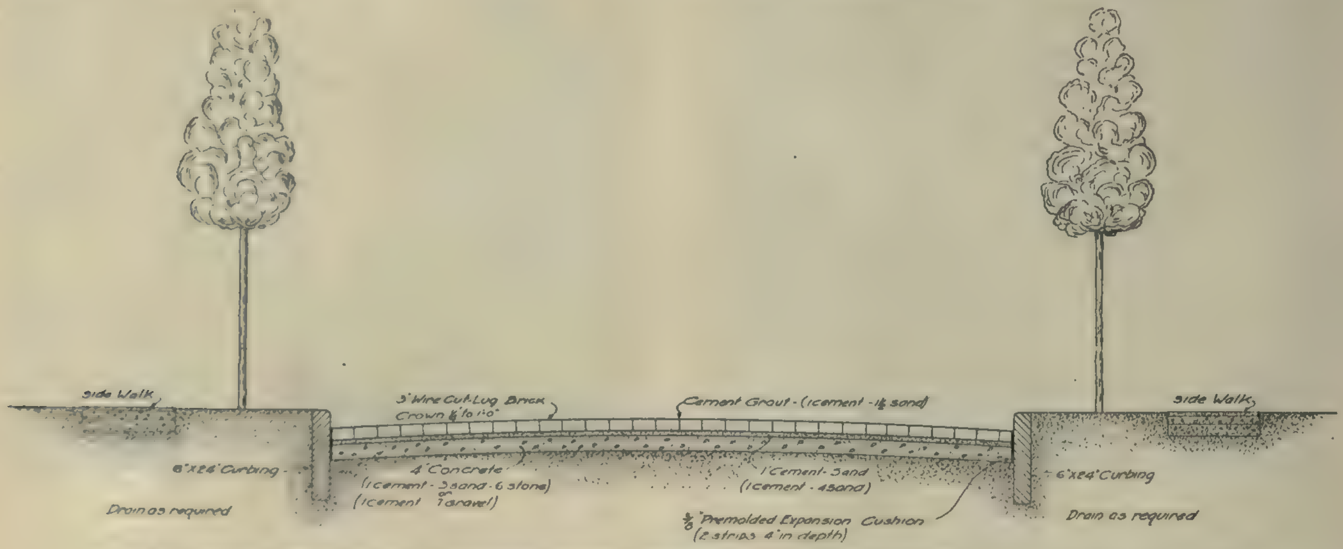

FIG. 3.—CROSS SECTION OF A STREET WITH A BRICK PAVEMENT OF THE SEMI-MONOLITHIC TYPE.

The concrete foundation is prepared practically the same as in the past for street paving. Its upper surface should be fairly smooth and of a uniform distance below the surface of the finished pavement. A variation of ½ in. either way from the exact contour and cross section is allowable; this variation would be taken care of by the superfoundation of cement-sand.

The thickness of the foundation depends largely on local conditions, the nature of the subsoil, the amount of traffic, and the cost of materials. The foundation should be designed to carry and distribute the load placed upon it and should be no deeper than is necessary to do its work. The foundation of 1:3:6 concrete is the best type for use under a brick wearing surface.

The cement-sand superfoundation, 1 in. in depth, should be considered by the engineer as 1 in. of the foundation, that is, if a 5-in. foundation is designed, the concrete should be only 4 in. thick, the 1 in. of cement-sand superfoundation being equivalent to 1 in. of concrete foundation.

This is the general practice when this type of construction is used, for by the method of construction the cement-sand superfoundation sets up as hard as the concrete foundation and practically becomes a part of the same.

Several important details should be strictly followed in preparing the cement-sand superfoundation. The sand and cement in proper proportion—and a mixture of 1 cement and 4 sand is recommended—should be thoroughly mixed dry in a mixer until it is of uniform color throughout. Experience has demonstrated that a damp sand will make a better mixture than one extremely dry. The mixture should be spread on the prepared foundation to a depth of 1 in. and carefully shaped by a template or other mechanical means to a true cross section parallel with, and 3 in.—or the depth of the brick wearing surface—below the cross section of the finished pavement.

It is not necessary to hand roll the cement-sand superfoundation but the operation of shaping it is of prime importance in securing the desired smoothness in the surface of the finished pavement.

Upon this prepared superfoundation the bricks should be immediately laid, inspected, culled, and rolled.

Attack on Mud Roads by an Illinois Association

The Champaign County Improvement Association in its efforts to secure better roads in the county recently sent out a communication containing the following excellent reasons why mud roads should not be longer tolerated:

Mud roads are an extravagance, which even a county so wealthy as this should no longer indulge in.

Mud roads cost you money every year and compel you to pay a premium on a disgrace to the county.

Mud roads stand as a barrier between you and your market, your church, your school and your friends.

Mud roads are an additional menace in time of emergency, delaying the arrival of the physician in answer to a sick call.

Mud roads affect the temper and in that way render you more susceptible to little worries, and eventually develop a grouch.

Mud roads prevent social events or reduce attendance and cause loss of the profit those affairs give a community.

Mud roads reduce the weight of the load and increase the period of time required to move it.

Mud roads make extra work of washing vehicles and currying animals and cleaning your shoes and clothing.

Mud roads are unsightly and a liability which constantly drains the pocketbook in more ways than can easily be mentioned.

Mud roads are never pointed out as a thing of beauty and cannot be hidden even from a blind person.

Mud roads are not roads; they are everything you do not want and hold you from many things you do want.

GOOD ROADS

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Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

FEBRUARY 3, 1917

THE CONVENTION AT BOSTON

As this issue of "Good Roads" goes to press plans for the convention of the American Road Builders' Association at Mechanics Hall, Boston, next week, have been practically completed, and there is everything to indicate that the meeting will equal, if not exceed, in interest and value the other meetings which have been held under the same auspices.

In general, the convention will be conducted along the lines of those of the past four or five years, for the methods employed by the organization have proved highly efficient, and as might be expected the managers of the meeting have apparently seen no reason to make any radical changes.

The eight sessions of the convention have been planned to give the maximum possible amount of time to open discussion, and the number of papers has been kept down to the minimum necessary to properly introduce and present the several subjects covered. In this connection it may be noted that the American Road Builders' Association is apparently the only organization of its kind which does not seem to regard the presentation of formal papers as the chief end of a road convention. Those having the program in charge are to be congratulated upon their recognition of the fallacy of this belief. Any one who has attended many meetings of the kind knows that the best points are very often brought out in informal discussion, and realizes that the practical value of meetings of the kind is very nearly proportional to the amount of time available for such discussion. Undoubtedly with this in mind, arrangements have been made for the discussion of various topics not formally announced in the program at two different sessions, by the means of a "Question Box."

As at recent A. R. B. A. conventions, the show will be an important adjunct to the meeting. The gathering of an exhibition of road building materials, machinery and equipment, which was inaugurated at the Columbus convention in 1909, has proved of great benefit to engineers and contractors and to manufacturers and dealers. Unusual facilities for the display of exhibits are afforded at Mechanics Building and the reservations of space show the appreciation of this fact and of the value of exhibits, on the part of exhibitors. Coming at the time of year at which the A. R. B. A. conventions are held, the displays of machinery, equipment and materials are especially timely, as they enable contractors and other users of machinery to inspect the exhibits well in advance of the opening of the working season. In addition, the gathering of exhibits into one place makes it possible for the contractor to examine in a few days more machinery than he could hope to see in as many weeks in any other way.

The entertainment features of the Boston program leave little to be desired. Besides the annual subscription A. R. B. A. dinner, the ball, and the smoker given by the Massachusetts Highway Association, a full program of entertainment has been arranged by the local entertainment committee. This committee, with the other local committees, is understood to have cooperated with the association officials most heartily and efficiently, and to the local committees as well as to the A. R. B. A. officials "Good Roads" extends its congratulations on the arrangements which have been made for the Boston meeting.

THE MOTOR TRUCK FOR ROAD WORK

On other pages of this issue is printed an article on the operation of the motor truck in road work, in which are pointed out some of the considerations governing the economical and efficient use of this machine by the road contractor. The article was written by the head of an organization making a business of motor transportation and should be read by all those whose work makes the matter of interest to them.

Much is heard of the motor truck as a destroyer of roads; less about it as a builder of roads. It has, however, come to occupy a very important place in road building equipment and if properly used can be made to yield high returns on the money invested.

Probably the most frequent use of the truck is that of hauling the various materials which enter into the construction of modern roads and pavements. There is also a very large amount of incidental road work for which the truck can be used advantageously. Some of these uses are shown in the illustrations accompanying the article to which reference has been made.

Especially interesting phases of motor truck operation in road work are the matters of loading and unloading. As indicated in the article, the economy of the use of the truck depends largely upon reducing the time required for these two operations and the suggestions made open up a field for profitable investigation and an opportunity to greatly improve present methods of carrying on work with the motor truck.

DEVELOPMENTS IN BRICK PAVING

A year ago there was printed in "Good Roads" a comprehensive article on "Methods of Brick Pavement Construction," in which there was reviewed the development of the monolithic and semi-monolithic types. In this issue there appears a series of extracts from a paper on the same topic, which was presented at the 1916 annual meeting of the American Association for the Advancement of Science by William C. Perkins of the Dunn Wire-Cut Lug Brick Co.

While neither the monolithic nor semi-monolithic method has been in use long enough to enable engineers to pass final judgment upon its merits, and opinion is still divided, as might be expected in the case of any departure from what through long usage has come to be regarded as standard practice, both methods seem to have grown in favor during the past year.

An especially important point made by Mr. Perkins in his paper is that of the use of 3-in. paving bricks. As pointed out, a considerable saving is made by this, especially in freight charges. The arguments made in favor of the 3-in. brick seem entirely reasonable and the adoption of that depth of brick should prove of considerable influence in increasing the amount of brick pavement laid by making the material available in areas remote from producing points where freight charges have previously made its use prohibitive.

Whatever the final verdict of engineers as to these two methods of construction, their development should be watched with the closest attention, for both have the approval of many of those who are in the best position to observe the results.

Wood Block Paving Specifications of the American Wood-Preservers' Association

The specifications for wood block paving adopted by the American Wood-Preservers' Association at its recent convention are presented herewith. Reference to these specifications is made elsewhere in this issue in the account of the meeting.

Timber

1.—Kind.—The wood from which the blocks are to be manufactured shall be Southern yellow pine, Douglas fir, tamarack, Norway pine, hemlock or black gum. Only one kind of wood shall be used in any one contract. The blocks must be sound and must be well manufactured, square butted, square edged, free from unsound, loose or hollow knots, knot holes, worm holes, and other defects, such as shakes, checks, etc., that would be detrimental to the blocks

In Southern yellow pine or Douglas fir the number of the annual rings in the 1 in., which begins 2 in. from the pith of the block, shall not be less than six, measured radially, provided, however, that blocks containing between five and six rings in this inch shall be accepted if they contain 33% or more of summer-wood. In case the block does not contain the pith, the 1 in. to be used shall begin 1 in. away from the ring which is nearest to the heart of the block. The blocks in each charge shall contain an average of at least 70% of heart-wood. No one block shall be accepted that contains less than 50% of heart-wood.

Size of Blocks

2.—The blocks shall be from 5 to 10 in. long, but should preferably average two times the depth. The depth shall be 4 in. for very heavy traffic streets, 3½ in. for moderate traffic streets, and 3 in. may be used for light traffic streets. However, where 3-in. block are used, no block shall be longer than 8 in. They shall be from 3 to 4 in. in width, but in any one city block all paving blocks shall be of uniform width. A variation of 1-16 in. shall be allowed in the depth and of 1-8 in. in the width of the blocks from the dimensions specified. In all cases the width shall be greater or less than the depth by at least ¼-in.

Preservatives

3.—The preservatives used shall be in accordance with the specifications that have been adopted by the Committee on Preservatives of the American Wood-Preservers' Association.

[These specifications are in complete detail and of great length and relate to the preservative that shall be used by manufacturers of creosoted wood paving block. They are not, therefore, included. The single sentence given above in the engineer's specifications will adequately cover the heading.—Ed.]

Treatment

4.—The timber may be either air-seasoned or green, but should preferably be treated within three months from the time it is sawed. Green timber and seasoned timber shall not, however, be treated together in the same charge. The blocks shall be treated in an airtight cylinder with the preservative specified. In all cases, whether thoroughly air-seasoned or green, they shall be first subjected to live steam at a temperature between 220° and 240°F. (in no case shall a steam pressure of 20 lb. per sq. in. be exceeded) for not less than two hours, nor more than four hours, at the discretion of the treating plant operator, after which they shall be subjected to a vacuum of not less than 22 in., held for at least one hour. While the vacuum is still on, the preservative oil, heated to a temperature of between 180° and 220°F., shall be run in until the cylinder is completely filled, care being taken that no air is admitted. Pressure shall then be gradually applied not to exceed 50 lb. at the end of the first hour, nor 100 lb. at the end of the second hour, and then maintained at not less than 100 nor more than 150 lb. until the wood has absorbed the required amount of oil.

The above treatment is recommended for yellow pine only. It is probably also suited for Norway pine, hemlock, black gum and tamarack, but not to Douglas fir. The Committee has reserved further recommendations for the treatment of these species.

After this a supplemental vacuum shall be applied in which the maximum intensity reached shall be at least 20 in., and which shall continue for a total period of not less than 30 minutes. If desired, this vacuum may be followed by a short steaming period.

In any charge, the blocks shall contain at least 16 lb. of water-free oil per cu. ft. of wood at the completion of the treatment. The blocks after treatment shall show satisfactory penetration of the preservative, and in all cases the oil must be diffused throughout the sapwood. To determine this, at least 25 blocks shall be selected from various parts of each charge, and sawed in half at right angles to the fibers through the center, and if more than one of these blocks show untreated sapwood the charge shall be re-treated. After re-treating, the charge shall again be subject to a similar inspection.

The surface of the blocks after treatment shall be free from deposits of objectionable substances, and all blocks that have been materially warped, checked or otherwise injured in the process of treating shall be rejected.

Handling the Blocks After Treatment

5.—The blocks shall preferably be laid in the street as soon as possible after being treated. If they cannot be laid immediately, provision shall be made to prevent them from drying out by stacking in close piles and covering them, and, if possible, by sprinkling them thoroughly at intervals. In any case, where they are not laid as soon as they are received on the street they shall be well sprinkled about two days before being laid, under the direction of the purchaser. It is important to have the wood sufficiently wet to be swelled to its maximum size before it is laid.

Inspection

6.—All material herein specified and processes used in the manufacture of the blocks therefrom shall be subject to inspection, acceptance or rejection at the plant of the manufacturer, which shall be equipped with all the necessary gauges, appliances and facilities to enable the inspector to satisfy himself that the requirements of the specifications are fulfilled.

The purchaser shall have the further right to inspect the blocks after delivery upon the street for the purpose of rejecting any blocks that do not meet these specifications, except that the plant inspection shall be final with respect to the kind of wood, rings per inch, oil and treatment.

Foundation

7.—The foundation for the pavement shall be of concrete, made in accordance with the specifications of the purchaser for concrete pavement foundation. At no place shall the surface of the finished concrete vary more than ½ in. from the given grade.

Mortar Cushion

8.—Upon the concrete foundation shall be spread a layer of thoroughly mixed mortar made from one part of Portland cement of the character provided for in the foundation, and four parts of sand. Only sufficient water shall be added to this mixture to insure a proper setting of the cement, the intention being to produce a granular mixture which may be raked to the desired grade. The mortar shall be spread in place on the foundation immediately in advance of the laying of the blocks. The mortar bed shall be raked to the approximate grade and struck by templates to a surface parallel to the grade and contour of the finished pavement. The finished mortar bed shall have an average thickness of not over ¾ in., and shall in no case be over 1 in. in thickness.

Laying the Blocks

9.—Upon the bed thus prepared the blocks shall be carefully set with the fiber of the wood vertical in straight parallel courses, leaving a space next to the curb 2 in. in width for the expansion joint.

The blocks shall be laid by setting them hand-tight on the base or cushion. No joint shall be more than 3-16 in. in width. They may be driven together every ten courses to keep the rows straight. Nothing but whole blocks shall be used, except in starting a course, or in such other cases as the purchaser may direct; and in no case shall the lap joint be less than 2 in. Closures shall be carefully cut and trimmed by experienced men.

The angle of course to the curb shall be fixed at the discretion of the purchaser.

After the blocks are placed on the mortar bed they shall be rolled parallel and diagonally to the curb by a tandem roller weighing between four and seven tons until the surface becomes smooth and is brought truly to the grade and the contour of the finished pavement. The rolling shall be completed before the mortar bed has set. All mortar that has set before the blocks are in place and rolled shall be discarded and replaced by fresh mortar.

After the rolling is completed the joints between the blocks shall be filled with a bituminous filler. This shall preferably be done only when the temperature of the air is above 45°F. The filler shall be brought to the proper temperature and poured into the joints, and the filler on the surface of the pavement must be spread as thinly as possible by means of squeegees. The filler shall be thoroughly worked into the joints between the blocks while hot, leaving no surplus on the pavement.

The surface shall then be completely covered to a depth of about ¼ in. with clean, coarse, dry sand, which shall be left upon the pavement.

Open-joint Construction.—When the blocks are laid on streets having grades of 3% or over, it is desirable that the blocks be spaced by laying creosoted wood lath about 5-16 in. in thickness between each course. The space above the lath shall then be filled with heated crushed stone from which all dust has been screened, and bituminous filler. The joints shall be poured about one-half full with the bituminous filler specified, care being taken to get none of this filler on the surface of the pavement. The crushed stone (it is very important to have the crushed stone heated, so that the bituminous filler will penetrate around it and make a solidly filled joint; if possible, the stone should be heated to 350°F. before it is applied) shall then be swept into the joint, and the space around the stone be filled with the bituminous filler to the top of the joint. It is essential, in open joint pavement, to drive the blocks together every four rows to prevent tipping of the individual blocks.

Filler

10.—Either coal tar pitch or asphalt fillers may be used. The following specifications shall be used for coal tar pitch fillers, and specifications for asphalt fillers will be presented at a later meeting of the Association:

The pitch used as filler shall be obtained entirely from the distillation of coal tar, and shall comply with the following requirements:

A.—The specific gravity at 77°F. shall not be less than 1.22 nor more than 1.34.

B.—Free carbon shall not be less than 18 nor more than 37%.

C.—The melting point shall not be less than 140°F. nor higher than 150°F. when determined by the ½-in. cube method. (On small jobs it is sometimes desirable to use pitch having a melting point from 135 to 145°F. because of the small kettles usually used, which are liable to raise the melting point considerably while the pitch is being heated).

D.—When 100 gm. of pitch are distilled to 670°F. in an 8-oz. retort, the specific gravity of the distillate shall not be less than 1.07 at 100°F.

Specific Gravity.—Ten gm. of pitch are weighed in a Hubbard type specific gravity bottle whose water capacity at 77°F. has been determined. The pitch is introduced into the bottle in a liquid condition and the weight is taken after cooling. Freshly boiled water is added, and the temperature is maintained. The water is adjusted to the mark, the bottle removed from the bath and weighed. The weight of the pitch, divided by the weight of the water displaced equals the specific gravity.

Free Carbon.—At least 5 gm. of pitch shall be used for this determination. The usual method of hot extraction shall be followed, using preferably the Knorr extraction apparatus. As a filtering medium, two sheets of 15-cm. 575, C. S. & S. filter paper are used. Chemically pure tuluol and chemically pure benzol are recommended as solvents, but benzol and chloroform, or benzol and carbon disulphide, can be used, in each case using the first named solvent for digestion and the last named solvent for extraction.

Melting Point.—A clean shaped ½-in. cube of the pitch is formed in a mold and placed on a hook of No. 12 copper wire, and then suspended in a 600-cc. beaker so that the bottom of the pitch is 1 in. above the bottom of the beaker. (A sheet of paper placed on the bottom of the beaker and conveniently weighted will prevent the pitch from sticking to the bottom of the beaker when it drops off.) The pitch is then to remain for five minutes in 400 cc. of water at a temperature of 60°F. before heat is applied. Then the heat is to be applied in such a manner that the temperature of the water is raised 9°F. each minute. The temperature recorded by the thermometer at the instant the pitch touches the bottom of the beaker is to be considered the melting point.

Thermometers in Kettles.—The kettles in which the filler is heated on the street shall be equipped with approved thermometers, and the pitch shall be heated to a temperature of not less than 250°F. nor more than 300°F., and it shall be poured when it is at a temperature between these limits.

Budget of the Pennsylvania State Highway Department for 1917 and 1918

A statement recently received from the Pennsylvania State Highway Department gives the appropriations requested by State Highway Commissioner Black for operations for the years 1917 and 1918 as follows:

State highway construction, $6,000,000 a year......	$12,000,000
State highway routes in boroughs, $1,000,000 a year, (To be used only in building missing links in boroughs, where state highway route is improved up to each end of borough, money to be allotted to counties on mileage basis. Unexpended balance in each county to be available for use on routes outside of boroughs.)......	2,000,000
State aid construction and maintenance, as per Acts of Assembly, $1,500,000 a year................	3,000,000
Purchase of turnpikes and toll bridges, $250,000 a year (local authorities in all cases paying 50 per cent. of cost of freeing toll roads and bridges	500,000
Township road bonus deficiency for 1912, 1913, 1914	1,350,000
Automobile license fees for state highway maintenance and necessary legislation, $3,000,000 a year	6,000,000
Total	$24,850,000

Second Apportionment of Federal Aid Funds

The apportionment of federal aid funds to the several states for the construction of rural post roads during the year ending June 30, 1918, has been made by the United States Department of Agriculture, in accordance with the provisions of the federal aid road act, 3% of the appropriation, or $300,000, having first been deducted to meet the cost of administration. The remaining $9,700,000 is divided as shown in the following table, one-third in the ratio of area, one-third in the ratio of population and one-third in the ratio of mileage rural delivery routes and star routes:

Alabama	$208,297.80	Nebraska	$213,541.62
Arizona	137,027.04	Nevada	128,796.60
Arkansas	165,378.20	New Hampshire	41,993.24
California	302,127.84	New Jersey	118,425.36
Colorado	167,380.28	New Mexico	157,475.62
Connecticut	62,180.88	New York	501,440.54
Delaware	16,368.74	North Carolina	228,763.84
Florida	111,952.54	North Dakota	152,286.12
Georgia	268,658.96	Ohio	373,810.84
Idaho	120,927.00	Oklahoma	230,278.00
Illinois	441,852.46	Oregon	157,374.74
Indiana	271,495.24	Pennsylvania	461,288.34
Iowa	292,351.20	Rhode Island	23,331.42
Kansas	286,414.80	South Carolina	143,615.28
Kentucky	194,943.82	South Dakota	161,892.04
Louisiana	134,949.32	Tennessee	228,306.96
Maine	96,903.00	Texas	583,855.62
Maryland	88,094.44	Utah	113,900.30
Massachusetts	147,701.90	Vermont	45,688.94
Michigan	291,567.44	Virginia	199,321.42
Minnesota	284,788.12	Washington	143,768.56
Mississippi	177,811.68	West Virginia	106,540.92
Missouri	339,440.82	Wisconsin	256,722.14
Montana	196,574.38	Wyoming	122,393.64

The appropriations for the years 1919, 1920 and 1921 are $15,000,000, $20,000,000 and $25,000,000, respectively. None of the above totals include the $1,000,000 yearly appropriation for the development of roads and trails within the national forests.

The American Road Builders' Association and the Boston Convention

The American Road Builders' Association which meets for its fourteenth annual convention at Boston, Mass., next week, is, as its name implies, an organization of road builders. Its membership consists chiefly of men actively engaged in the work of building and maintaining roads and streets, including the officials of state, county, city and town highway departments, engineers in public employ and in private practice, contractors, manufacturers of and dealers in road building materials and equipment, and others engaged in similar lines. It is the oldest organization of its kind in the country and has held a series of very successful conventions.

The first convention of the A. R. B. A. was held at Detroit, Mich., Feb. 13 and 14, 1903, and the next at Hartford, Conn., Feb. 10 and 11, 1904. Other conventions have been held as follows: Port Huron, Mich., Aug. 29-31, 1905; Pittsburg, Pa., March 12-14, 1907; Buffalo, N. Y., July 7 and 8, 1908; Columbus, Ohio, Oct. 26-29, 1909; Indianapolis, Ind., Dec. 6-9, 1910; Rochester, N. Y., Nov. 14-17, 1911; Cincinnati, Ohio, Dec. 3-6, 1912; Philadelphia, Pa., Dec. 9-12, 1913; Chicago, Ill., Dec. 14-18, 1914; Oakland, Cal., Sept. 13-17, 1915, and Pittsburg, Pa., Feb. 28 to March 3, 1916.

At the Columbus convention in 1909 an exhibition of road building materials and machinery was held in conjunction with the convention. This innovation proved so successful that the exhibition has become a permanent feature of the convention having been omitted only in 1915 when the convention was held at the time of the Panama Pacific International Exposition. The first exhibition at Columbus comprised about 40 exhibits of machinery and materials; the number has since increased to over 100.

Until 1910 the association was known as the American Road Makers' Association, its membership consisting principally of the officials of the states having state highway departments. In 1910 the name was changed to the American Road Builders' Association and it was chartered without capital under the laws of New York State. It had by that time become a large factor in road betterment throughout the country and had increased very greatly in membership. Since 1910 the association has continued to grow in membership and in importance and today is the only organization of its kind in the United States and the leading national good roads organization.

The objects of the association as set forth in its constitution are the acquirement and dissemination of information on highway construction in the United States and Canada, the stimulation of interest in the subject of road improvement and the promotion of educational, legislative and other measures for road betterment. The membership is divided into five classes—active, associate, honorary, contributing and life members. Active members are those who are actively engaged in "laying out or supervising work of construction and maintenance of highways and streets and those interested in highway development." Associate members are societies or other organizations interested in the objects of the association. Honorary members are those "who have performed distinguished service in the cause of highway extension and improvement." Contributing members are commercial organizations contributing $100 annually to the organization. Life members are active or associate members who make a payment of $500 upon election to membership. Active members only are permitted to vote or hold office in the organization. Dues for active members are $3.00 per year; for associate members $10.00.

The control of the association is vested in a board of directors consisting of the executive officers, the last five living past presidents and 18 elected members. The board appoints an executive committee of three, one of whom must be the secretary of the association, to have actual charge of the association's business. The executive officers are a president, three vice presidents, a secretary and a treasurer. These are elected for 1-year terms, while the directors are elected for 3-year terms, six being elected each year.

The present officers of the American Road Builders' Association are as follows:

President, A. W. Dean, Chief Engineer, Massachusetts Highway Commission; First Vice President, William H. Connell, Chief, Bureau of Highways and Street Cleaning, Philadelphia, Pa.; Second Vice President, Austin B. Fletcher, State Highway Engineer of California; Third Vice President, Arthur H. Blanchard, Professor of Highway Engineering, Columbia University; Secretary, E. L. Powers, Editor, "Good Roads"; Treasurer, W. W. Crosby, Consulting Engineer, Baltimore, Md.

Past Presidents (ex-officio Members of the Board of Directors): Nelson P. Lewis, Chief Engineer, Board of Estimate and Apportionment, New York, N. Y.; Samuel Hill, Honorary Life President, Washington State Good Roads Association; W. A. McLean, Deputy Minister of Highways, Province of Ontario; George W. Tillson, Consulting Engineer to the President of the Borough of Brooklyn, New York, N. Y.; Col. E. A. Stevens, Commissioner of Public Roads of New Jersey.

Directors (terms expire 1920): T. R. Agg, Professor of Highway Engineering, Iowa State College; W. E. Atkinson, State Highway Engineer of Louisiana; Fred E. Ellis, Manager, Essex Trap Rock & Construction Co.; R. H. Gillespie, Chief Engineer of Sewers and Highways, Borough of the Bronx, New York, N. Y.; M. Michaud, Deputy Minister, Department of Roads, Province of Quebec, Canada; Paul D. Sargent, Chief Engineer, Maine State Highway Commission.

Directors (terms expire 1919): R. Keith Compton, Chairman and Consulting Engineer, Paving Commission of Baltimore, Md.; Charles W. Gates, ex-Governor of Vermont; James H. Macdonald, ex-State Highway Commissioner of Connecticut; R. A. Meeker, State Highway Engineer of New Jersey; William D. Uhler, Chief Engineer, Pennsylvania State Highway Department; Frank M. Williams, State Engineer and Surveyor of New York.

Directors (terms expire 1918): E. A. Fisher, former City Engineer of Rochester, N. Y.; A. R. Hirst, State Highway Engineer of Wisconsin; Joseph W. Hunter, First Deputy Commissioner, Pennsylvania State Highway Department; Frank F. Rogers, State Highway Commissioner of Michigan; William R. Smith, President, Lane Construction Corporation; H. M. Waite, City Manager of Dayton, Ohio.

The fourteenth annual convention, as has been noted in previous issues of "Good Roads," will be held at Mechanics Building, Boston, Mass., on Tuesday, Wednesday, Thursday and Friday of next week. The sessions of the convention and the exhibition will be accommodated in the same building as has been the case at most of the recent meetings of the organization. The exhibition, according to present plans, will be opened on Monday forenoon and the first session will be held on Tuesday forenoon.

Mechanics Building, in which the convention is to be held, is conveniently situated in the Back Bay section of the city. Ample hotel accommodations are available in the vicinity and other parts of the city can be easily reached from the convention building and the headquarters of the American Road Builders' Association at the Hotel Copley-Plaza.

An elaborate entertainment program for delegates and guests has been prepared by the local entertainment committee. The personnel of this committee and other local committees is as follows:

Committee on Finance: Chester I. Campbell, Chairman; Charles P. Price, John C. Runkle, George C. Warren.

Committee on Entertainment: George W. McNear, Chairman; Joshua Atwood, 3rd, Joseph S. Donovan, J. S. Hathaway, Hector J. Hughes, J. H. Johnson, D. A. Kennedy, John M. McCarthy, H. S. Potter, Charles P. Price, John R. Rablin, Ransome Rowe, J. T. Sullivan, Addison L. Winship.

Committee on Accommodations: L. C. Prior, Chairman; J. Linfield Damoh, Jr., E. C. Fogg, Frank C. Hall, C. J. Hart.

Committee on Press: C. F. Marden, Chairman; J. H. Devlin, R. T. Jones, J. C. Kerrison, E. J. McNamara, E. W. Preston, J. T. Sullivan.

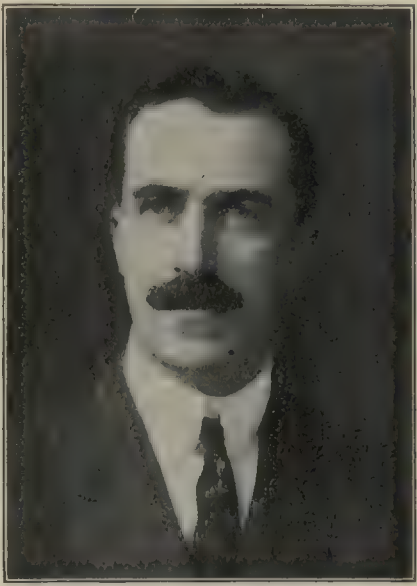
Committee on Transportation and Information: John M. Keyes, Chairman; W. A. Barrows, C. M. Burt, William A. Morris, A. B. Smith.

Committee on Ladies' Entertainment: Mesdames James M. Head, Chairman; William Henry Allen, Joshua Atwood, 3rd, James M. Curley, E. W. Daly, Roger Dix, J. S. Hathaway, Samuel W. McCall, W. J. McDonald, George W. McNear, Ransome Rowe, A. M. Wright.

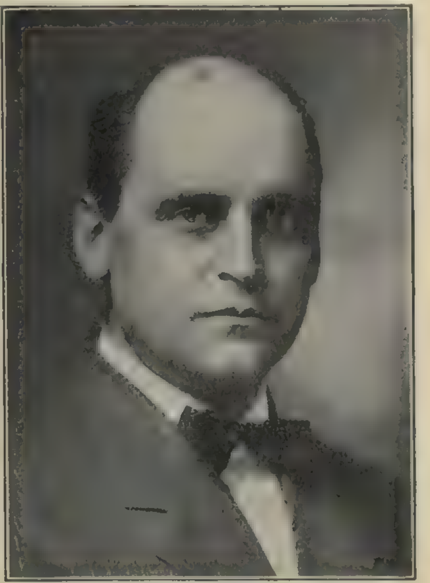
General Secretary: Paul C. Cummings, Manager Convention Bureau, Boston Chamber of Commerce.

The program of the convention, corrected to date of going to press, is printed below. Slight changes may be made before the opening of the convention, but as a whole, the program is final. In arrangement, the program is similar to those of the conventions held by the A. R. B. A. during the past two years. The number of papers is kept down to the minimum so as to allow ample opportunity for discussion. A slight departure from the usual plan has been made in the assignment of a particular subject to each session or to a definite part of a session. Provisions have also been made for an open discussion under the head of "Question Box" on Thursday afternoon and Friday forenoon.

WM. H. CONNELL,
First Vice President.



A. W. DEAN,
President.



AUSTIN B. FLETCHER,
Second Vice President.

MAJ. W. W. CROSBY,
Treasurer.

ARTHUR H. BLANCHARD,
Third Vice President.

E. L. POWERS,
Secretary.

EXECUTIVE OFFICERS OF THE AMERICAN ROAD BUILDERS' ASSOCIATION.

Program of the Fourteenth Annual Convention of the American Road Builders' Association

MONDAY, FEBRUARY 5

Registration of delegates and visitors during day and evening at Mechanics Building.

10:00 a. m. Formal opening of Eighth National Good Roads Show.

8:00 p. m. Informal reception to exhibitors by the President and other officers of the American Road Builders' Association at Mechanics Building.

TUESDAY, FEBRUARY 6

Registration of delegates and visitors during day and evening.

10:00 a. m. Meetings of Committee.

First Session, 11:00 a. m.

Congress called to order in convention hall by the President of the American Road Builders' Association.

Address of welcome on behalf of the State of Massachusetts by Governor Samuel W. McCall.

Address of welcome on behalf of the City of Boston by Mayor James M. Curley.

Address of welcome on behalf of the Massachusetts Highway Commission by Col. Wm. D. Sohier, Chairman.

Address of welcome on behalf of the Boston Chamber of Commerce by Henry I. Harriman, Vice President.

Address of welcome on behalf of the Massachusetts State Automobile Association by Geo. W. McNear, President.

Address of welcome on behalf of the Massachusetts Highway Association by John M. Keyes, Vice President.

Response on behalf of the American Road Builders' Association by A. W. Dean, President.

Appointment of Committees.

Second Session, 2:00 p. m.

"Policy and Program of Government in Road Construction Under New Federal Aid Law," Logan Waller Page, Director, Office of Public Roads and Rural Engineering, U. S. Department of Agriculture.

Discussion.

Subject: Water Bound Macadam, Gravel, Earth, Sand-Clay and Miscellaneous Roads and Pavements.

"Earth and Gravel Road Maintenance," R. L. Morrison, Professor of Highway Engineering, Agricultural and Mechanical College of Texas.

Discussion.

7:30 p. m.

Entertainment and Smoker by the Massachusetts Highway Association, Convention Hall, corner Garrison and St. Botolph Sts.

WEDNESDAY, FEBRUARY 7

Third Session, 10:00 a. m.

Subject: Bituminous Roads and Pavements and Treatments (Sheet Asphalt, Bituminous Macadam, Bituminous Concrete, etc., etc.).

"Bituminous Roads and Pavements," Wm. R. Farrington, Division Engineer, Massachusetts Highway Commission.

Discussion.

Fourth Session, 2:00 p. m.

Subject: Cement Concrete Roads and Pavements.

"Best Practice in Concrete Road Construction," H. E. Breed, First Deputy Commissioner, New York State Commission of Highways.

Discussion.

7:00 a. m.

Annual A. R. B. A. Dinner, Hotel Copley-Plaza.

THURSDAY, FEBRUARY 8

Fifth Session, 10:00 a. m.

Subject: Stone Block Pavements.

"Recent Practice in Granite Block Pavements," Wm. H. Connell, Chief, Bureau of Highways and Street Cleaning of Philadelphia, Pa.

Discussion.

Subject: Wood Block Pavements.

"Recent Practice in Wood Block Pavements," Ellis R. Dutton, Assistant City Engineer, Minneapolis, Minn.

Discussion.

Sixth Session, 2:00 P. M.

Subject: Brick Pavements.

"Best Practice in Brick Pavement Construction," F. R. Williams, Paving Engineer of Cleveland, Ohio.

Discussion.

QUESTION BOX.

(Questions to be discussed must be handed in at the registration booth by Wednesday noon)

4:00 p. m. Reports of Committees.

4:30 p. m. Business meeting.

8:00 p. m.

Reception and Ball (formal), Hotel Copley-Plaza.

Reception 8 to 9 p. m.

Dancing 8 to 12 p. m.

Receiving: Governor and Mrs. Samuel W. McCall, Mayor and Mrs. James M. Curley, Colonel and Mrs. Wm. D. Sohier, Mr. and Mrs. Arthur W. Dean.

Cards of admission may be obtained at Convention Headquarters, American Road Builders' Association, Mechanics Building.

FRIDAY, FEBRUARY 9

Seventh Session, 10:00 a. m.

Subject: Contractor's Plant or Equipment.

"The Excavation, Manipulation and Transportation of Materials," John H. Gordon.

Discussion.

QUESTION BOX (continued).

Subject: Traffic—Its Effect on Design, Construction and Maintenance and its Regulation.

"Traffic Census; Its Application to the Design of Roadways, Selection of Pavements and Traffic Regulation," D. B. Goodsell, Assistant Engineer, Department of Public Works, Borough of Manhattan, New York, N. Y.

Discussion.

Unfinished discussion or other business.

Adjournment.

Note: On Friday evening at 8 o'clock Mr. Samuel C. Lancaster, Engineer for the Columbia Highway, will deliver a lecture on the Columbia Highway, in Horticultural Hall. Mr. Lancaster's lecture will be illustrated by motion pictures. All delegates and visitors are cordially invited.

MEETINGS

Calendar of Coming Meetings

February 5-9.—American Road Builders' Association—Fourteenth Annual Convention; Seventh American Good Roads Congress under the auspices of the A. R. B. A., and Eighth National Good Roads Show of Machinery and Materials. Mechanics' Hall, Boston, Mass. Secretary, E. L. Powers, 150 Nassau Street, New York, N. Y.

February 7-15.—Tenth Chicago Cement Show—Coliseum, Chicago, Ill. Secretary, Blaine S. Smith, 210 South La Salle street, Chicago, Ill.

February 8-10.—American Concrete Institute—Annual meeting, Hotel LaSalle, Chicago, Ill. Secretary, Harold D. Hynes, 1418 Walnut Street, Philadelphia, Pa.

Feb. 9.—Texas Town and City Planning Association.—Semi-annual convention, Sherman, Tex. Secretary, J. E. Suratt, Sherman, Tex.

February 13-14—Pikes Peak Ocean to Ocean Highway Association—National annual convention, St. Joseph Mo. Secretary, A. W. Henderson, Colorado Springs, Colo.

February 19-24.—Southwestern Concrete Association—Annual meeting and show, Kansas City, Mo. Chairman of committee, Charles A. Stevenson, 1433 West 10th St., Kansas City, Mo.

March 5-6—National Paving Brick Manufacturers' Association—Annual convention, Hotel McAlpin, New York, N. Y. Secretary, Will P. Blair, Cleveland, Ohio.

March 5-7—American Ceramic Society—Annual meeting, Hotel Astor, New York, N. Y. Secretary, Edward Orton, Columbus, O.

April 17-20.—U. S. Good Roads Association.—Fifth annual convention, Birmingham, Ala. Secretary, J. A. Rountree, 1021 Brown Marx Building, Birmingham, Ala

American Wood-Preservers' Association

The thirteenth annual meeting of the American Wood-Preservers' Association was held at Hotel Astor, New York, N. Y., Jan. 23-25, inclusive, and was probably the most interesting and the best attended meeting that this association has ever held. The entire session on the closing day of the meeting was devoted to the subject of wood blocks, and there was considerable discussion over the specifications for wood block paving as recommended for adoption by the association. These specifications were revised in several places prior to their being presented by Chairman Clyde H. Teesdale, and will be found, complete as revised and finally adopted by a vote of three to one of the members present, on another page. The principal discussion and dissension was over section 4, on the treatment of the blocks, some of the authorities present taking a positive stand against the committee in that the alternative of air-seasoned or green timber should not be allowed, and that only green timber should be used. An amendment to the effect was made and lost by a large majority, and the specifications as presented are given as recommended practice.

The committee advised that the specifications were not intended to be used in their entirety in every case, but that where more than one material or method was given the engineer was to select that best suited to the particular case and draw his own specification accordingly.

Another excellent report that was presented at this session was that on the service test of wood block paving. This report, presented by the committee which has had this work in charge, is of considerable length and purely statistical, containing very interesting and valuable data on wood block paving in cities in all parts of the country. The report was accepted and the session unanimously voted to have the committee continued throughout the present year to report on the subject again at the next annual meeting with additional data and information.

An interesting appendix to the report of the Committee on Wood-Block Paving, submitted by Clyde H. Teesdale, in charge of the section on wood preserving, and John A. Newlin, in charge of the section of timber tests of the Forest Products Laboratory, Madison, Wis., was also presented.

Following the presentation of the reports on wood block paving, the committee on resolutions presented its report, and the result of the election of officers for 1917 was announced by the tellers. The new officers are as follows: President, John Foley, Forester of the Pensylvania Railroad, Philadelphia, Pa.; First Vice President, M. K. Trumbull, Vice President of the National Lumber & Creosoting Co., Kansas City, Mo.; Second Vice President, J. S. Card, General Manager, Chicago Creosoting Co., Chicago, Ill.; Secretary and Treasurer, F. J. Angier, Superintendent of Timber Preservation of the Baltimore & Ohio Railroad, Baltimore, Md.

In turn, each of the newly elected officers was escorted to the chair and made a few very brief addresses. The meeting was then adjourned after it had been decided to hold the annual meeting in 1918 in Chicago.

Resolutions Adopted by the Virginia Road Builders' Association

At the recent annual meeting of the Virginia Road Builders' Association, at which the name of the association was changed to "The Virginia Good Roads Association," resolutions were passed recommending that the legislature of Virginia make an appropriation from the state treasury of an amount sufficient to meet the United States government appropriation under the federal aid act, for use exclusively in constructing main state highways; that in addition to the automobile tax which now amounts to approximately $300,000 a year, "a special tax be levied on all vehicles of every character using the public highways of the state, the proceeds of such tax to be set aside for road construction and maintenance."

The Committee on Resolutions also reommended that state convicts be employed on the public roads under the direction of the State Highway Commission; that the state highway law be amended to permit the State Highway Commission to fix the salaries of its employees, subject to the approval of the governor; that a uniform state law be passed regulating the width of tires, and fixing the minimum width at 3 in. except for pleasure vehicles; and that the State Corporation Commission be requested to urge the railroads in the state "to adopt uniform and efficient danger signs and signals at all crossings where it is at present impracticable for overhead or under-grade crossings to be constructed." and to prevent the use of similar signs for advertising purposes.

Members of the Resolutions Committee were as follows: W. C. Saunders, Chairman, Board of Supervisors of Henrico County; E. R. Monroe, Chairman, Street Committee, Town of Brookneal; S. L. Lupton, Frederick County; C. B. Scott, Assistant State Highway Commissioner; Geo. F. Harrison, Supervisor, Fairfax County; W. R. Rawlins, Supervisor, Elizabeth City County; J. A. Hardy, Supervisor, Nottaway County; W. S. Embrey, Spotsylvania County; Ashton Fletcher, Supervisor, Accomac County; Frank J. Motley, Supervisor, Richmond County.

Western Paving Brick Manufacturers' Association

The annual meeting of the Western Paving Brick Manufacturers' Association was held in the Dwight Building, Kansas City, Mo., on Friday and Saturday, Jan. 19 and 20. On Friday morning the preliminary routine work of the meeting was disposed of, after which a luncheon was given the delegates at the Baltimore Hotel. The afternoon was occupied with the reading of papers by G. L. McLane, City Engineer, Hutchinson, Kan., on "Monolithic Roads," and James F. McCabe, Association Representative, on "The Bright Side of Paving Promotion." On Friday evening a banquet was held at the Baltimore Hotel.

On Saturday forenoon annual reports for the year 1916 were submitted, followed by the election of officers. After luncheon a paper was read by F. C. Aschemeyer, Sales Manager, Hydraulic Press Brick Co., St. Louis, Mo., on "Salesmanship." During the two-day session the six traveling representatives of the association exchanged ideas as to the promotion and better construction of "vitrified brick pavements and highways." The evening of Saturday was occupied with a dinner at the Baltimore Hotel and a theater party.

Officers elected were: President, A. W. Shulthis, Independence, Kan.; Vice President, H. J. Huiskamp, Buffalo, Kan.; Secretary, G. W. Thurston, Kansas City, Mo.; Treasurer, Frans Janssen, Kansas City, Mo.

Notes

The American Association of Engineers, which was organized in 1915 with the avowed object of raising "the standard of ethics of the engineering profession and to promote the economic and social welfare of engineers," will hold a national convention in the Hotel La Salle, Chicago, Ill., Feb. 8-10. Papers and addresses will be presented by a number of men identified with the engineering profession. Inquiries should be addressed to the American Association of Engineers, 29 La Salle St., Chicago, Ill.

According to advices from the Southwestern Concrete Association which holds its annual meeting and show at Kansas City, Mo., Feb. 19-24, about 75 exhibitors will have space at the show. Among the exhibits will be a joint exhibit by the Portland cement companies operating in the central West. These companies will occupy one end of the hall and will show among other things a model of road construction. The show will be open to the public during the entire six days of the convention. The sessions of the convention will begin on Tuesday morning, Feb. 20.

PERSONAL NOTES

B. W. Macy has been appointed City Engineer of Salem, Oregon.

Charles Lawrence has been appointed City Engineer of Warren, Ohio.

F. W. Boyd has been made County Engineer of Rogers County, Oklahoma.

B. B. Hanson has resigned as County Engineer of Mitchell County, Iowa, and is succeeded by Clifford Goplerud, who has headquarters at Osage.

Newell D. Darlington, a member of the State Highway Commission of California, has been elected chairman of the commission. He replaces Charles D. Barney, who resigned recently.

William M. Acheson has withdrawn his resignation from the Engineering Department of the New York State Commission of Highways, and will continue his work as Division Engineer with headquarters at Buffalo, N. Y.

R. H. Harrison has not severed his connection with the Office of Public Roads as was inferred in an item printed under "Personal Notes" in the issue of Jan. 13. As stated in this note, Mr. Harrison has been given charge of road work in Albemarle County, Virginia, but he has been assigned to this by the Office of Public Roads and Rural Engineering, with which he is still connected. Mr. Harrison will act as County Highway Engineer of the county.

PUBLICATIONS

DISTRICT OF COLUMBIA, ENGINEERING DEPARTMENT. Report of Operations for the Year ending June 30, 1916. Paper, 6x9 in., 181 pp. and covers.

Included in this report are detailed data on the work of the Engineer Department of the District of Columbia, including the general report of the Commissioners and the report of the Engineer of Highways, the Inspector of Asphalts and Cements and other subordinate officers.

"PUBLIC ROAD MILEAGE AND REVENUE IN THE NEW ENGLAND STATES, 1914." Bulletin No. 388. U. S. Department of Agriculture, contribution from the Office of Public Roads and Rural Engineering, issued January 8, 1917. Paper, 6x9 in., 74 pp.

This bulletin is a companion work to Bulletin 386 of the department entitled "Public Road Mileage and Revenues in the Middle Atlantic States, 1914," which was noted in "Good Roads" for October 7, 1916. In general it follows the plan of the other bulletin, containing matter describing methods empoyed in securing the data, and chapters describing in detail the road mileage and road revenues in Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut. The appendices contain tabular data on road and bridge revenues, bond issues, and road mileages in each of the states.

"PRACTICAL STREET CONSTRUCTION." By A. Prescott Folwell, Editor, "Municipal Journal," reprinted from a series of articles printed in the "Municipal Journal" during 1916. Cloth, 6x9 in., 248 pp., illustrated. Municipal Journal and Engineer, 50 Union Square, New York, N. Y. $2.00.

As explained in the preface, this book consists largely of articles prepared by the editorial department of the "Municipal Journal" during 1916. One chapter, however, that entitled "Street Planning in Newark," is an abstract of part of a report by the City Plan Commission of that city. Chapters 9 and 10 were written by H. C. Hutchins, and Chapter 15 consists largely of extracts from a report of the Philadelphia Board of Surveyors. The chapter headings of the book are as follows: What Streets Are Used For; Planning Street Alignment; Diagonal Thoroughfares (3 chapters); Planning Thoroughfares (2 chapters); Street Planning in Newark; Street Widths (3 chapters); Sidewalk Widths; Minor Residence Streets; Local and Elastic Streets; Philadelphia Elastic Streets; Street Cross Section (4 chapters); Motor Trucks and Street Grades; Street Grades; Planning Grades; Grade at Intersection; Intersection Grades (2 chapters); Gutters; Sidewalks and Sidewalk Construction; Sidewalk Obstructions. The book is profusely illustrated by half-tone reproductions of photographs of streets and street work in various cities and by diagrams showing street plans, cross sections and the like.

EQUIPMENT — TRADE — MATERIALS

A Bitoslag Pavement in Allegheny County, Pa.

A Bitoslag pavement built about a year ago in Allegheny County, Pa., is shown in the accompanying illustration. The pavement is on a portion of the Steubenville Pike, a main highway carrying a large amount of traffic. It was built by the Thomas Cronin Co., of Pittsburgh, which was awarded the contract by the County Commissioners of Allegheny County, Pennsylvania, in the spring of 1916. It is about 2 mi. in length. A selection of this type of pavement was made by the Allegheny County authorities after investigating similar pavements laid in McKeesport and Philadelphia.

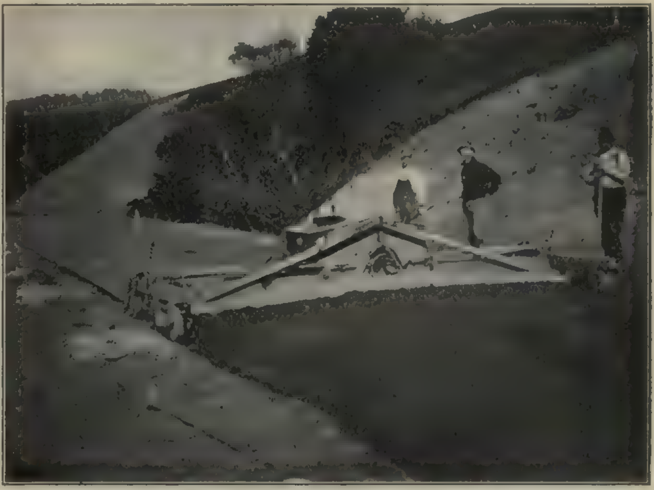
The Bitoslag pavement is an asphaltic concrete pavement in which the aggregate is air cooled blast furnace slag, ranging in size from ¼ in. to fine dust. It is mixed with specially treated asphalt, known under the trade name of Bitoslag cement and laid under a patent held by the Bitoslag Paving Co., of New York, N. Y.

The pavement on the Steubenville Pike was laid on the old macadam as a foundation. Before laying the pavement all depressions and holes in the road, which was deeply rutted and badly worn, were filled with broken stone and the surface brought to grade. Scantlings, 2x4 in. in size, were laid at the edges of the road and held by steel spikes to restrain the edges of the pavement during rolling. The roadway was then thoroughly cleaned and the pavement laid. The surfacing was mixed in a Cummer railroad plant at Pittsburgh and hauled to the work in motor trucks. The haul averaged between 7 and 8 mi. The material on arrival was dumped and immediately spread to a depth giving a finished thickness of 2 in. after rolling with an 8-ton roller.

The road was built under the supervision of William McClurg Donley, Road Commissioner of Allegheny County.

Concrete Road Tamping Machine

A tamping machine which, according to reports, has been used successfully in concrete road construction in California, is shown in the accompanying illustration.



COWELL CONCRETE ROAD TAMPING MACHINE

The machine, as shown, runs longitudinally along the road on flanged wheels rolling on side forms. It follows closely after the mixer, leveling off the concrete, tamping it and finishing it in one operation. The machine is driven by a 1½-hp. gasoline engine and is provided with a traction device for moving it along the road under its own power. The machine is provided with two templates, the forward

BITOSLAG PAVEMENT ON THE STEUBENVILLE PIKE, ALLEGHENY COUNTY, PA.

one working horizontally to level off the concrete and the other one working up and down to accomplish the tamping. The machine is built in various sizes for roads of different width and is stated to be able to level, tamp and finish 200 lin. ft. of pavement per hour.

The machine is known as the Cowell concrete road tamping machine and is manufactured by the Cowell Portland Cement Co., of Cowell, Cal.

New Erie Roller Catalog

A new catalog of Erie Tandem Rollers has recently been issued by the Erie Machine Shops of Erie, Pa. The catalog is 8¼x11 in. in size, and consists of 16 pages and covers. The pages are held in the covers by paper fasteners in such a way as to permit ready removal.

The pages carry text matter describing in detail the construction of the roller and a number of excellent illustrations, one being a general view of the roller, one a detailed view of the engine, another showing the front portion of the machine, another the main roll, and another the construction of the frame.

Good Roads Machinery Co. Catalog

The Good Roads Machinery Co. of Kennett Square, Pa., has recently issued a complete catalog of the equipment handled by that company.

The catalog is 10x7 in. in size and consists of 64 pp. and covers. Included in the machinery illustrated and described are road machines of various sizes and types, road drags, wheeled and drag scrapers, grading and rooter plows, rock crushers, stone bins, stone elevators, screens, portable engines and boilers, dump cars, tripod drills, portable gravel screening plants, road rollers, distributors, heating kettles, pouring pots, concrete mixers, car unloaders, street sprinklers, culvert pipe, municipal castings, and small tools.

Motor Truck Used to Haul Road Material

Considerable road work was done last season at Grosse Isle, the Detroit River island used as a summer home by many wealthy residents of Detroit, Mich. All of the broken stone used in the work had to be hauled from the quarry on the mainland, the haul varying from 3 to 7½ mi.

Teams and a 4-ton Packard motor truck equipped with a dump body were employed for hauling. According to reports, the owner of truck figured that it did the work of six 2-horse teams. Seven teams were working at the same time as the truck and in 10 hours hauled 49.5 tons of stone, while over a period of 105 days of 10 hours each the truck averaged 45.1 tons and 79.5 mi. per day. During the last three weeks of the work, it is stated, it became necessary to rush the work in order to finish before winter, and during this period the truck was operated 23 hours each day, hauling an average of 98.9 tons per day.

Notes

The East Iron and Machine Co., of Lima, Ohio, has recently sold Merriman one car railroad asphalt plants to the H. G. Goelitz Co., Oak Park, Ill.; the Andrews Paving Co., Hamilton, Ont., and the Columbus Paving Co., Columbus, Ohio.

The Duplex Truck Co. of Lansing, Mich., has purchased the patents, plant and business of the Duplex Power Car Co., and will hereafter manufacture and market the Duplex 4-wheel drive truck. The company is at present operating its Charlotte plant and at the same time making arrangements for the construction of the Lansing plant, which will give it a maximum capacity of 10 trucks a day. The plans of the company call for commencing operation of the Lansing plant by Sept. 1, 1917. The officers of the company are H. M. Lee, President and General Manager; H. E. Bradner, Vice President, and G. W. Hewitt, Secretary-Treasurer. The board of directors consists of these officers, with H. F. Harper and Elgin Mifflin, both of Lansing.

The American Cement Machine Co., Inc., of Keokuk, Iowa, decided at its annual meeting to increase its capital to $120,000, an increase of $70,000. This step was taken to meet an increase in business of over $160,000 in a period of seven months. The increase in capital became available Feb. 1.

A 16-page booklet bearing the above title and the subtitle, "A Record of Experience From Which There Was Evolved a Wearing Surface to Carry Successfully the Exceptionally Heavy Traffic of London's Famous Thoroughfare," has been issued by the Barber Asphalt Paving Co., Philadelphia. It describes the embankment and the pavements laid on it from 1905 to the present time. It is 6x9 in. in size, is printed on white paper of good quality and is illustrated by three full-page half-tone reproductions of photographs of portions of the embankment.

Bulletin No. 70A, Second Edition, issued by the Sullivan Machinery Co., of Chicago, Ill., describes and illustrates Sullivan rotator hammer drills, Classes DP-33 and DR-33. These drills are made in five different styles which are illustrated and described in the bulletin. These incude a drill with a hollow piston, a drill with an air tube, one with a tube for use with steam, and one with a water tube for cleaning the hole. Two styles of mountings are also described. The auger type "rotators" for use in soft ground are also fully described in the bulletin and a number of illustrations are included showing the application of these drills to different kinds of work.

NEWS NOTES

The Winter Haven Special Road District in Florida passed a bond issue of $325,000 on Jan. 19 by a vote of 253 to 18. The money will be used for hard-surfacing the roads of that district.

The Capitol-to-Capitol Tour of the Hupmobile car was completed at Washington, D. C., on Jan. 18. The car left Washington on Aug. 28, 1916, and covered 19,861 mi. in its visit to the capitol of each state of the Union. The party secured a large number of road pictures and reports for the American Automobile Association and the National Highways Association.

Road Building and Maintenance in South Africa has been overshadowed by railroad construction, according to United States Vice Consul Honaker, at Johannesburg. But that the subject has not been entirely neglected is evidenced by some of the mountain roads which still arouse the interest of engineers. The municipality has 775.4 mi. of roads, varying in width from 41 to 124 ft., the street area being 26.6% of the township area. Rock suitable for road building, such as sandstone, shale and quartzite, with some deposits of granite and diabase, is found in small quantities, the two last named being unsatisfactory on account of irregularity of formation after being crushed. Waste rock from the mines, known as "blue bar," is the material used, being cheap and more suitable for road building. The method of constructing roads with this material is similar to that in general use. Native South African laborers are employed under white overseers at 40 ct. a day. The initial cost of paving averages about $12,847 per mi., 12 yd. wide. Maintenance is a heavy burden on the municipality on account of the large street area, and because roads built of the material named do not wear well under heavy traffic, the cost being 20 ct. per sq. yd. or about $4.282 per mi. per annum within the central areas.

GOOD ROADS

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Number 6

Details of the Construction of a Bituminous Carpeted Macadam Road

By HENRY MARSHALL OLMSTED*

In July of last year the writer commenced the construction of a road in Bayonne Park, Bayonne, N. J. The road is about 1.17 mi. long and is 30 ft. wide except on one section about 800 ft. long, where the width is 35 ft. The date of the start of the work is given because of its bearing on the methods of construction.

The roadway consists of two courses of broken trap rock carpeted with Tarvia B and washed pea gravel. The stone used was Rockland Lake (N. Y.) trap rock having a specific gravity of 3.0. The stone used in the bottom course was known as 2½-in stone, and was defined by the specifications as stone passing a 3¼-in. ring and retained on a 2⅛-in. ring. The 1½-in. stone used in the top course was broken to pass a 2¼-in. ring and to be retained on a 1⅛-in. ring.

Frequent tests of the size of the stone were made with a pocket tester consisting of a piece of pine wood ¼ in. thick in which were bored holes, one 3¼ in., one 2⅛ in., one 2¼ in. and one 1⅛ in. in diameter. The results of two tests of 1½-in. stone are given in the following tables.

The material from barge No. 3 was rejected and that from barge No. 4 was accepted. At least 75% of the stone for the top course should be of the proper size, that is out of 100 stones picked up at random 75 should meet the ring test as to size. Strikes, delays, lateness of the season and

TEST OF MATERIAL FROM BARGE NO. 3

Size of Stone.	Number of Stones. Test No. 1	2	3	Total.	Percentage.
Proper size	40	47	34	121	42.5
Under size	38	26	39	103	36.2
Thin slabs	14	27	20	61	21.3
Total	92	100	93	285	100.0

TEST OF MATERIAL FROM BARGE NO. 4

Size of Stone.	Number of Stones. Test No. 1	2	3	Total.	Percentage.
Proper size	79	95	100	274	66.0
Under size	17	60	45	122	27.0
Thin slabs	3	13	15	31	7.0
Total	99	168	160	427	100.0

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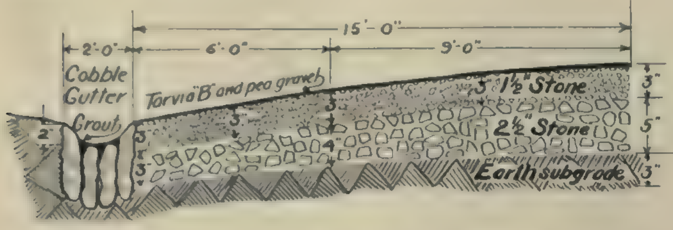
*Highway Engineer, Brooklyn, N. Y.

DRIVE IN BAYONNE PARK, BAYONNE, N. J.—LOOKING TOWARD NEWARK BAY—BITUMINOUS CARPETED MACADAM ROAD WITH COBBLE GUTTERS.

conditions beyond control forced our acceptance of some stone only 35% to 50% perfect.

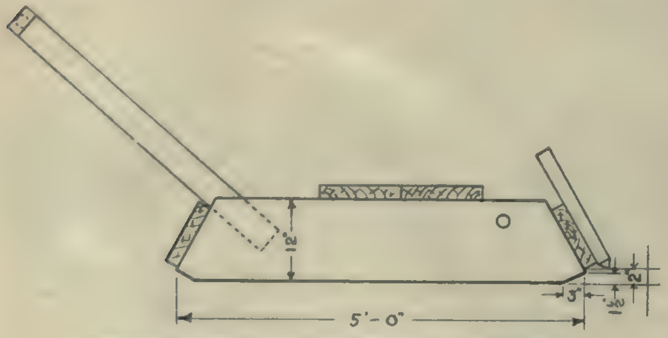
Prior to the writer's connection with the work there had been ordered trap rock screenings designated as "¼-in. to ½-in. particles free from dust." A few loads were delivered but satisfactory results could not be obtained with the material. It would not enter the voids and possessed no binding value. It was finally rejected and the screenings from ⅛-in to ¼-in. in size and dust, the latter amounting to about 30% of the entire volume, were used. These screenings possessed sufficient cementing power to hold the stone in place until the application of the "carpet" and gave good results.



CROSS SECTION OF PARK ROADS—HORIZONTAL SCALE ¼ VERTICAL SCALE.

The material was delivered to the work by 2½-yd. dump wagons and 5-yd. Packard motor trucks. As a rule six teams and two trucks were used. The distance from the dock to the work was 2 mi. The trucks made 20 round trips daily delivering 100 cu. yd. at a cost of 10 ct. per cu. yd. The teams made 7 round trips a day delivering 17½ cu. yd. at a cost of 30 ct. per cu. yd. The trucks were valued at $5,100 each and the teams at $800 each. In addition to the cheaper transportation cost with the trucks there was a decided advantage in placing the stone, as the trucks spread the stone on the road in a long ribbon of any required thickness.

In the construction of the road it was necessary to rebuild only a few parts of the subgrade. The stone was generally spread by the wagons or the trucks, but it was occasionally necessary to dump the stone in piles, shoveling it on the road later and bringing it to the proper thickness and proper level. The first course before rolling was 4 in. deep at the gutters, 5 in. deep at the shoulders and 6 in. at the crown. The rolling reduced this to 3 in. at the gutters, 4 in. at the shoulders and 5 in. at the crown. The second course was spread 4 in. deep over the entire road and rolled to 3 in., making the thickness of stone in the completed road 6 in. at the gutters, 7 in. at the shoulders, and 8 in. at the crown.



SIDE ELEVATION OF STONE LEVELER

The loose stone was spread to the required thickness by means of the stone leveler, designed by the writer. A side elevation of this is shown in one of the accompanying sketches. It consisted of two runners of 1½-in. plank, 5 ft. long and 12 in. high, placed upright side by side and held 7 ft. apart, with pieces of 1½-in. plank at the ends for spreading the material. The end runners were shaped at the front and back as shown in the sketch. The cross plank at the front acted as a plow, but at the same time allowed the stone to flow under it, while the cross piece at the rear dragged the stone along for a way and then permitted it to slide under the edge. To facilitate the plowing action a 2x4-in. stake, pointed at the lower end, was attached to the center of the front cross piece. The leveler was drawn by two horses hitched to the leveler by chains through the holes in the front of the side pieces.

On a measured area of 1,000 sq. yd. covered with irregularly piled stone heaps, 2 and 3 ft. high, the stone was leveled to a thickness of 4 in. in 3 hours at a cost of $2.10. To do this by hand would have taken 20 men 9 hours and would have cost $40. Wood blocks, 4, 5, and 6 in. high, set on the road, were used to guide the laborers in leveling. The rolling was done with 12-ton rollers. The subgrade was thoroughly rolled and the bottom course of stone was rolled five times before placing screenings. The roller was started at the gutters and worked up to the crown by 8-in. laps of the rear wheels. After rolling the bottom course, a 1-in. layer of screenings was applied by shovels from piles along the road. The best results were obtained by covering the area to be filled lightly several times, rolling while spreading was in progress. In damp weather the screenings stuck in the upper part of the stone course and had to be worked down into position by means of fiber push brooms. After the lower course had been filled the screenings were broomed off and out of the surface to a depth of about ¼ in. in order to leave the stone sticking up to form a bond with the second course. About 1 in. of screenings were required for the lower course. After the screenings were all in place the surface was watered. A 700-gal. sprinkling wagon was used and was run about five times over the first course.

Screenings to a thickness of ¾ in. were required for the top course. They were worked into the stone by the same methods employed for the lower course. After filling this course, it was watered, about eight trips of the sprinkler being made. The course was again rolled and a thin layer of screenings applied to the surface, leaving screenings to a depth of ⅛ to ¼ in. remaining on the road. The adequacy of the rolling was determined by the "feel under foot" by the "feel conveyed to feet of roller man," by "watching rear wheels and noting that surface did not creep or give," and finally by the change in the color of the surface from a solid to a dappled gray, the white spots being the tops of stones beginning to show.

After the completion of the macadam all dust and surplus screenings were brushed from the surface, first with wire push brooms and then with fiber push brooms. This exposed the surface stones to a depth of about ⅛ in. On completing this operation, the necessity for perfect 1½-in. stone became very apparent as smaller stones would be broken loose from the surface by the operation. In one part of the road where under-sized stone had been used, we were obliged to dig out the old material, put in fresh screenings, roll, water, and roll again and then broom the entire area a second time. This sweeping of the surface removed from the total area of 21,500 sq. yd. about 12 wagon loads of surplus screenings which I later used again. After brooming, the surface presented a rough, uniform surface. A part of the screenings were used to form ridges on the inside of the gutters to prevent the surplus bituminous material from running into the gutters.

The material for the "carpet" consisted of Tarvia B, which was applied from a 1200-gal. motor distributor. The material was applied through spray nozzles under 20 lb. pressure. Four trips were required to cover the 30-ft. width of road. The material was applied hot when the road was perfectly dry, the penetration being about ½ in. The material was applied at the rate of about .5 gal. per sq. yd. In mild, sunny weather the Tarvia was allowed about 24 hours to penetrate the road, but in damp weather about twice as long.

The Tarvia was covered with clean washed pea gravel free from sand and consisting of particles 1/16 to ¼ in. in diameter. This was applied from piles placed on the side of the road, 1 cu. yd. covering about 100 sq. yds. of road surface. After application the gravel was leveled by wooden garden rakes, any over-sized particles being removed at the same time. The road was then rolled twice, the dust ridges removed from the gutters, and the road opened to traffic.

The cost of the work per square yard, exclusive of grading, the building of gutters, bridges and drains, was as follows:

Stone	$0.3851
Screenings	0.1220
Pea gravel	0.0200
Tarvia B	0.0459
Teams	0.0160
Rolling	0.1030
Labor	0.3080
Total, per sq. yd.	$1.0000

Under favorable market conditions the work could have been done for 75 ct. per sq. yd. The estimated cost of maintenance is $300 per year or 1.4 ct. per sq. yd. annually. This indicates a total cost at the end of ten years of $1.14 per sq. yd.

DRIVE IN BAYONNE PARK, BAYONNE, N. J.—VIEW SHOWING FIRST COURSE OF BROKEN STONE IN PLACE

New Road Law Proposed for Missouri

A bill providing for the repeal of the present State Highway Department act, the revision of certain portions of the state road law, and the creation of a state highway department, was recently introduced in the Legislature of Missouri by State Representative Harry B. Hawes.

Under the terms of the measure the State Highway Department is to be composed of a state highway board of four members appointed by the Governor, a state highway engineer appointed by the board, at a salary of $6,000 a year, and the necessary employees. The bill provides that the state highway engineer shall lay out a system of state roads not less than 3,500 mi. nor more than 4,000 mi. in length, with a minimum of 30 mi. in each county, and that motor car license funds be increased and used for the construction of such roads. The bill is designed to enable Missouri to take advantage of the apportionment made the state by the federal government under the act of July 11, 1916.

According to latest advices, the proposed law has been favorably reported by the House Committee on Roads and Highways.

Road School at the Kansas State Agricultural College

The second annual road school of the Kansas State Agricultural College was held in connection with the State Farm and Home Week, or Institute, at the College, Manhattan, Kan., Feb. 5-9, inclusive. The program was arranged to give each county engineer an opportunity to present a phase of road work in which he had had considerable experience and to permit other county engineers to discuss it, and thus inform each other as to the results accomplished.

The road course included a number of addresses and papers by highway officials and authorities on highway work, among them being the following: "Highway Bridge Financing and Administration," W. S. Gearhart, State Engineer of Kansas; "Federal Aid in Highway Construction," J. C. Wonders, Division Engineer, United States Office of Public Roads and Rural Engineering; "Financing Surfaced Roads," John C. Nicholson, Chairman, Legislative Committee, 365-Day Road Club; "Protection of Roads and Bridges from Encroaching Streams," H. B. Walker, State Drainage and Irrigating Engineer, Kansas State Agricultural College; "Testing of Road Materials," W. B. Wendt, Assistant in Applied Mechanics, Kansas State Agricultural College; "Highway Engineering Education," L. E. Conrad, Professor of Civil Engineering, Kansas State Agricultural College; "Road Machinery, Its Care and Use," C. M. Cooper, County Engineer of Cherokee County; and an address by Robert C. Terrell, Professor of Highway Engineering, University of Oklahoma.

Papers Presented at the Fourteenth Annual Convention of the American Road Builders' Association—I

Note: Other papers presented at the Convention will appear in a later issue of "Good Roads."

Earth and Gravel Road Maintenance

By R. L. MORRISON,

Professor of Highway Engineering, Agricultural and Mechanical College of Texas

In our frantic efforts to develop a type of road which will carry successfully the burden of an ever-increasing daily traffic of thousands of motor vehicles, often including heavy trucks in inter-city freight service, and to economically maintain these roads after they are built, we are apt to scorn, or at least to overlook, the problem of maintaining the humble earth road. The proper care of our hard surfaced roads, in the construction of which we have invested over a billion dollars, is an immense problem, but a still greater one is the maintenance of our earth roads which still constitute nearly 90% of our entire road mileage. Not all sections of the country have improved roads, but there is no community so small or so large, so poor or so rich that it is not confronted with the problem of getting the best possible service from the earth road. Hard-surfaced roads can be obtained only by spending more money, but our earth roads can be vastly improved simply by an efficient use of the funds which are now being spent with such poor results.

An earth road is a fairly good road if it is hard and smooth, and this is the object to be attained by proper maintenance. In the case of an earth road, maintenance should be taken into consideration before construction begins, for the difference between good and bad construction is mainly a matter of the resulting effect upon maintenance. A road can never be kept hard and smooth if it is so poorly located that all the surrounding land drains into it, or if the waterways are so small that they do not carry the water properly. In fact, a properly constructed earth road usually means simply a well drained road.

The first maintenance operation should usually consist of shaping up the road with a grader and under ordinary conditions this should be done once or twice a year. The road grader is a very effective machine if properly used, but it should be in charge of a skillful and sensible operator. Cutting should usually begin at the sides, and if the roadside is covered with sod and weeds the blade should be set on the first round in such a way that this material will be scraped into the ditches instead of onto the road. It can then be removed with shovels. Sometimes the entire road surface is covered with worn-out material mixed with dead leaves, manure, etc., and in that case this layer of worthless material should first be scraped into the ditches, or else into windrows, and then carried away in wagons. Such detritus not only makes a poor road surface, but it washes to the sides and hastens the growth of sod and weeds which seriously interfere with proper crown drainage. Often this growth on the shoulders can be removed to advantage with a spring-tooth harrow or a hand cultivator. Whatever the means employed, care should be taken to see that this material is entirely removed from the roadway and ditches.

A common mistake is to make the width between ditches too great. A width of from 16 to 24 ft. is usually sufficient, and unnecessary width means additional expense for maintenance. If the roadway has been made too wide in the first place, new ditches should be made nearer together. Stakes should be set to guide the workmen, and, if necessary, a plow should be used to loosen the earth at the sides.

In shaping up the road with a grader some operators begin at the sides and use the entire width of the blade, if possible, the blade being set almost at right angles with the center line of the road so that enough material is carried along to fill up the ruts and holes. Other operators begin just outside of the wheel track and work toward the side, instead of beginning at the sides and moving a constantly increasing mass of earth. Instead of using the entire width of the blade they raise the heel, thus allowing the earth to pass under the heel of the blade. This tends to break up clods and puddle the material. Whichever method is used, enough material is moved toward the center at each round to build up a proper crown, but it must be remembered that a crown of one inch to the foot is sufficient. And it should not be made any steeper. A steep crown forces all traffic to follow in the same tracks, which rapidly forms ruts. Distributing the traffic over the surface helps to save the road.

The road grader should be properly cared for. The blade should be kept sharpened, and worn-out blades should be renewed promptly. In many places the use of traction engines or road rollers to pull graders has proved economical, one engine often pulling two graders.

The proper use of a road drag is so generally understood that it is hardly necessary to discuss it before an audience of road builders. It may be well to state, however that wonderfully efficient as it is, the road drag is endowed with neither brains nor judgment, and if these are not possessed by the operator, good results can hardly be expected. Often the drag is used at the wrong time, or in the wrong way, or only once or twice when it should be used many times. Too many drivers seem to think that their only duty is to keep the team moving, and the almost pathetic sight of a split-log drag stirring up clouds of dust on a perfectly dry road is occasionally encountered. After it has been operated in this fashion for a while, the drag is very likely to be seen at the side of the road, somewhere, with tall weeds growing around it and between the logs, while the local officials assert that they have tried dragging and found that it is not worth while.

To the engineer or road superintendent who understands what should be done to the earth road, the problem is mainly one of organization, and the greatest obstacles are apt to be legal rather than technical. The old system of working out road taxes was discarded in France over a hundred and fifty years ago because of its obvious inefficiency, but in most parts of the United States this antiquated system is still firmly implanted. This makes the situation discouraging but not hopeless. The work can be carefully planned ahead, the road hands can be called out a few at a time, and can be worked under experienced foremen who are continuously employed.

In many states contracts are made with the farmers to drag the roads near their farms at a certain rate per mile or per hour. If a county is divided into districts in charge of competent foremen, the farmers in each district can be called out by telephone at the proper time and the work can be inspected by the foremen. The road dragging usually interferes very little with the farmers' regular work.

If the district foremen are regularly employed and supplied with teams, tools, and extra helpers as required, their work supplemented by the dragging done by the farmers, will keep the roads in excellent condition at a comparatively low cost. Each district should include 20 to 30 mi. of road. To the best of the writer's knowledge this plan was originated in Minnesota and is almost universally employed in that state.

Another system which seems to be efficient is a part-time patrol system under which the roads are divided into short sections, usually 3 to 5 mi. in length, and a man supplied with the proper tools is put in charge of each section. This differs from the regular patrol system in that the man does not devote his entire time to the care of the road, but his other employment is made secondary to the road work.

Many engineers claim that the ordinary continuous patrol system is not adapted to the maintenance of earth roads, but experiments by the Office of Public Roads and Rural Engineering seem to indicate that this system is at least worthy of consideration in that connection.

The gravel road probably ranks next to the earth road in total mileage. On many trunk highways, of course, a gravel surface would be entirely unsatisfactory, but we must not overlook the fact that on roads carrying comparatively light traffic the annual interest cost of a more substantial pavement may exceed the maintenance cost of gravel. And especially in the more thinly populated sections of the West and South, with low property valuations, gravel will continue for a long time to be the most widely used surfacing material. This makes the proper maintenance of gravel roads a problem of paramount importance in many states.

With this type of road the regular patrol system seems to be the most economical and efficient, the patrol sections being from 5 to 10 mi. in length. This is especially true because a small hole in a gravel road unless immediately repaired soon becomes a large hole. A few large holes mean a ruined road and a large expense for resurfacing.

The greatest amount of maintenance work is required during the first few months after the road has been built, before it has become thoroughly compacted and settled by traffic. The surface is likely to become badly cut up in wet weather and to ravel in dry weather. The first condition is most likely to occur if there is too much clay in the gravel, and the second if there is too little clay. During this time a road grader is usually the best tool to use, as the blade will cut off high spots, fill up hollows, and keep the crown shaped up more effectively than a drag. Opinions differ, however, as to the comparative value of the scraper and the drag for this work. The crown should be about ¾ in. per foot, giving for instance, a crown of 6 in. on a 16-ft. road. If the crown is made steeper than this, all traffic will keep to the center of the road and quickly form ruts.

If the gravel contains a great excess of clay it will be necessary to add a thin layer of sand-gravel free from clay. If, on the other hand, the gravel does not contain sufficient clay to properly bind the surface, a layer of clay may be added and harrowed into the gravel. Usually from 10 to 20% of clay makes a satisfactory binder. If the surface does not immediately "set up" it should not be hastily concluded that there is too little binder; in fact, a road which sets up too soon is apt to cut up later on.

Scraping or dragging should be done immediately after a rain, while the road is soft enough to be worked. A scraper has some effect upon a dry road, especially where the gravel is displaced through lack of sufficient binder, but a drag should always be used when the road is wet. At first the scraping or dragging should be done after every rain, and scraping may be necessary between rains, but as the road becomes compacted by traffic this work need not be done so often. After the first few months a drag will be as effective as a scraper, but the cutting edges of the drag should be protected by iron over their entire length.

Although the drag will keep the surface smooth and fill up small depressions, it is usually necessary to do more or less patching. The patrolman can go over his road during, or just after, a rain and locate the depressions by the standing water. If there is any mud in the hole it should be carefully cleaned out and the bottom should be loosened up with a pick. Unless the road is wet the hole should be thoroughly sprinkled before it is filled. The loosening and sprinkling will insure a bond between the old and the new material. Large stones should not be used in shallow depressions, and the top of the finished patch should be just high enough so that it will be even with the road surface when compacted. If it is left too high, holes will be formed at each end of where the wagon wheels drop off.

Piles of gravel should be left at intervals of about half a mile along the roadside, to be used for patching, and enough material should be left in each pile so that it will not be scattered before it is used. This gravel should, if possible, be the same material as that used in the original construction.

When the surfacing becomes so badly worn that patching is no longer sufficient, the road must be entirely resurfaced. This work can best be done in the spring when the road is comparatively soft. All vegetable matter and other refuse should first be removed from the road surface, and then the old gravel should be scarified and reshaped before the layer of new material is put on. The scarifying can often be done with a heavy harrow. If the harrow brings large stones to the surface they should be removed. Before the new gravel is put on, the old surface should be well sprinkled to insure a good bond with the new gravel, and, if possible, it should also be rolled. The new material, similar to the top layer of a new road, is then put on, shaped, and, if possible, rolled. The surface should be kept smooth with a scraper or drag until it is well compacted.

Sometimes a road wears out sooner than it should because it is too narrow. On a narrow road vehicles are forced to follow the same track and ruts are formed much sooner than if there is an opportunity for the traffic to spread out over a wider surface. If the road is too narrow the new surface can be extended out beyond the old one at the sides. There will be less traffic on the sides than near the middle, so that it will do no harm to have this portion thinner than the rest.

It will add to the life of a gravel road to roll it every spring, whether extensive repairs are made or not, and it is also a good plan to roll it after the first rains in the fall. The rolling should be done when the road is fairly soft, but not while water is standing upon it.

The dragging and small repairs needed annually cost as a rule from $20 to $50; though sometimes $100 or more, per mile per year. Resurfacing usually has to be done at intervals of from 5 to 10 years at a cost equal to about two-thirds of the cost of the original gravel surface. Dividing this cost by the number of years between resurfacings, and adding the annual cost of dragging and small repairs, gives a total annual cost of from $150 to $300 per mi. to keep the roads in first-class condition perpetually.

The cost of maintaining gravel roads has been reduced in some cases by the use of motor trucks. The trucks are used to pull graders, drags and scarifiers, as well as for hauling gravel, and a single truck sometimes does the work of a good many horses. The economy of using motor trucks depends a good deal upon the class of men employed as drivers. If the drivers are skillful, careful and sober men, and fairly good mechanics, the repair bills and lost time will be small, but if the trucks are put in charge of petty politicians, or shiftless voters who need the jobs most, the repair bills will be high and the trucks will be in the shop a large part of the time.

Apparently an ordinary gravel road will not carry economically more than about 150 motor cars per day without a bituminous surface treatment. Heavy asphaltic oils and tars have been used for this purpose with success, but satisfactory results are not as easily obtained as in treating macadam roads. A double treatment first with light tar and then with a heavier tar has proved satisfactory, even on a poor grade of gravel, and a double treatment of oil has also been successfully used.

Nothing has been said about the proper care of shoulders, side ditches, culverts, etc., but what is necessary along that line is well understood by all experienced road builders. In fact, much of the preceding discussion may seem elementary, but the maintenance of earth and gravel roads is so universally neglected, at least in Texas, that some of these elementary principles may well be brought to the attention even of highway engineers.

The Latest Developments in Brick Pavement Construction

By **FRED R. WILLIAMS,**

Engineer of Paving, Cleveland, Ohio.

Cleveland is the population, and, therefore, the industrial and financial center of northern Ohio. As such it absorbs practically all the agricultural produce of the surrounding territory, the greater proportion of which is delivered over the road. It is within motor truck transportation distance of such busy industrial cities as Akron and Youngstown and large quantities of goods are exchanged by this means.

In order to realize the maximum benefit from this kind of transportation the exchange must be effected with dispatch, at regular intervals, and with uninterrupted service the year around.

The constant increase in opportunity for this kind of traffic, coupled with the large amount of pleasure traffic arising in a city of 700,000, has led through a period of 20 years to the development of an extensive road system in, and radiating from Cleveland, for the most part paved with brick.

The development in the types of brick pavement construction employed both within the limits of Cleveland and outside on the county roads, represents the progressive adaptation of pavement type to the amount and kind of traffic to be served.

The present types of construction of brick streets and highways in Cleveland and Cuyahoga County were gradually developed from earlier experiences. These changes were brought about by the demand for smooth, easy riding pavements of sufficient strength to withstand the increased traffic of the present day; at the same time pavements which combined cost and service satisfactorily.

When clay soil is encountered a concrete base should always be specified, but latterly, the change has been to one of the monolithic type, using a 4-in. brick.

Experience has shown that under conditions existing at the time of the installation of the early pavements in the City of Cleveland, the selection of brick as a wearing surface laid on the natural foundation was an economical one.

The first brick pavement in the City of Cleveland was laid in 1887 on East 65th St., between Euclid and Curtis Aves. This pavement is recorded as built of fire brick laid on a natural foundation. No record was made of the kind of filler used. A couple of years later a section of Linwood Ave. was paved with a small plain wire-cut brick with tar filler. This also was laid on a natural foundation.

From 1887 up to about 1900 many plain wire-cut brick, tar filled pavements were laid in the City of Cleveland. While the brick in these pavements are all rounded, the general surface is fairly uniform and many of the streets are still in a usable condition.

About 1898 the standard 5-in. block came into use in the City of Cleveland. These were laid on a natural sand foundation, using cement grout filler. This type of pavement when soil conditions are naturally favorable or proper provision is made artificially for drainage, gives us one of the most economical pavements for residential or medium traffic. The type is still in use in certain residential sections of Cleveland.

The gradual change in types of construction of brick pavements occurred in the county in the same order as that in the city, but started at a later date.

The first brick road in Cuyahoga County was that laid on Wooster Pike during the years between 1893 and 1895. This pavement, 8 ft. in width, was laid on a 6-in. broken stone foundation, using tar for filler. No adequate drainage was provided and depressions soon developed. It remained in service, however, for nearly twenty years, when it was replaced with a brick pavement 30 ft. wide.

About 1895, State Road was built with 4-in. brick for a wearing surface and 4-in. concrete for foundation. Cement grout was used as the filler on this road.

The first pavement in Cleveland laid on a concrete base was that laid in 1898 on Lexington Ave. This pavement consisted of a 5-in. standard size block, laid on a 6-in. concrete base with a 2-in. sand cushion. Several years later double car tracks were laid in this street, thus renewing the central 15 ft. of the roadway. That part of the original pavement remaining is in fairly good condition today.

The use of concrete as a foundation has increased since that date and at the present the majority of pavements laid have a concrete base specified. Up until 1915 the sand cushion was used between the brick and base. During that year both city and county started to use the cement-sand cushion type, and following that the green concrete foundation type. Four-inch bricks have been used by the city in the green concrete foundation type, while the county has used both 4-in. and 3-in. brick, depending upon the traffic to be served. Since 1900, with few exceptions, cement grout has been used both by the city and county as the joint filler.

Construction.—The essential parts or elements in the construction of a brick pavement are preparing the sub-grade, building the foundation, laying the bedding course, and laying the brick wearing surface.

Subgrade.—In preparing the subgrade, the important features to be considered are thorough drainage, uniform density or firmness and contour of surface. A careful study of local conditions should be made to determine what drainage for the road or street must be provided in the absence of natural drainage.

Drains should be supplied to carry away all water from the subgrade to a depth of at least 2 ft. They should be laid behind both curbs for the entire length of the pavement. A large percentage of the longitudinal cracks are undoubtedly caused by frost expansion due to a wet subgrade. I understand that very few cracks occur in the southern part of the United States, from which it is generally concluded that a great majority of our longitudinal cracks are due to temperature effects in combination with saturated subgrades.

Uniform density or firmness of the subgrade can be secured only after it has been properly drained. All spongy soil should be replaced by suitable material. In making fills material should be deposited in layers not exceeding 8 in. in thickness and each layer should be rolled until the soil is thoroughly compacted. In excavation great care should be taken to prevent any disturbance of the soil below the subgrade. In Cleveland contractors are required to grade within 3 in. of the final subgrade, then to construct small earthen dams dividing the roadbed approximately into squares. The street is flooded with water until the subgrade has been properly puddled or settled. The roadbed is then brought to the proper crown and any additional excavation required is made by the use of picks and shovels.

In order to secure a uniform subgrade the curbs are set to the proper grade and line and used as guides for the work of fine grading. Curbing should be set in a bed of cinders or sand and thoroughly underdrained as required. The subgrade should be completely rolled with a roller loaded to weigh from 7 to 8 tons. All places that can not be properly rolled should be hand tamped.

Foundations.—In considering the type of foundation to be used, the amount and kind of traffic, character of the soil and the cost should be considered. It has been the practice in Cleveland to lay the brick on the natural soil if it is sandy and the street is located in a purely residential section. In sections where clay soil appears, a concrete base should be used. The top surface of the concrete base should be smooth, uniform and parallel to the desired finished surface of the pavement. Where the cement-sand or green concrete foundation type is to be used, before placing the concrete, a prepared expansion cushion should be placed against each curb. It should have a depth equal to the combined thickness of the brick, bedding course and concrete foundation.

Bedding Course.—In the past this has generally been the sand cushion. The use of a plain sand cushion or bedding course has undoubtedly been the cause of many failures of brick pavement due to lack of compression or to excessive thickness. Many good pavements have been constructed using a plain sand cushion, but on account of the hazard which neglect on the part of the contractor to give special attention to this important part of the pavement introduces, it is gradually being displaced by the cement-sand bedding course, which should not be more than 1 in. in thickness.

A great objection to the use of the sand cushion is that the sand will work up between the bricks, thus partially filling the space intended for grout and reducing the depth of effective bond.

It used to be the practice of the contractor to make up in the cushion any excess of depth due to careless grading. During the past season on streets where a cement-sand bedding course was specified, contractors exercised great care to obtain the proper subgrade, as they would be required to make up any excess with the more expensive cement-sand mixture.

The cement-sand bedding course, 1 in. in thickness, composed of 1 part of cement and 3 parts of sand is carefully shaped to the true cross section parallel with the finished pavement by means of a template covering one-half of the roadway so made as to be easily drawn over the curb.

The cement and sand for the bedding course is mixed, preferably in a small batch mixer before being spread on the concrete foundation. Less manipulation is required with the cement-sand bedding course than was formerly needed with the plain sand cushion, by reason of its greater density and uniformity at the outset, when it is thoroughly pre-mixed. It has been found that the operation of spreading and striking off the bedding course, and subsequently laying the brick thereon, proceeds more readily when the sand is slightly damp than when it is extremely dry.

Green Concrete Foundation Type.—This and the preceding pavement described are known as monolithic types. The end sought in both types is the same, namely, a firm union of base and wearing surface. In the cement-sand bedding course type this union is secured by a cementitious bedding course; in the green concrete foundation type, by laying the brick on the green concrete foundation. In the latter, there is no bedding course employed other than a thin film of dry mortar spread by special template at the same time the concrete is cut to its proper contour and elevation.

Uniformity in mixing the concrete is an important factor in securing the best results with the green concrete foundation type. A quaking mix has been found most satisfactory since this assures enough water for hydrating the cement, making it easy of handling and at the same time providing a stable support for the brick surface during laying and rolling. In no event should so much water be used that the excess flows to the side of the street, washing with it cement and sand out of the coarse aggregate.

As yet, I have not been able to secure any lower bids for this type of construction in Cleveland than for the cement-sand bedding course type. I think this is due to the fact that by reason of being wholly unfamiliar with it, contractors bid higher than necessary to protect themselves against what they feared might prove to be a loss. I anticipate lower bids as they gain confidence and experience with it.

Cement Grout Filler.—The operation of applying the cement grout filler in any type is one requiring care throughout if the full advantages inherent to the type of filler are to be realized. The best results are secured with a thorough pre-mixing of the cement and sand in the proportions of 1 part cement to 1 part sand. A small amount, approximately 2 cu. ft., is then placed in the box and water gradually added; in the meantime the whole is thoroughly mixed.

Complete mixing in the box is an important factor in preventing separation between the cement and sand at the time of application, in fact, a large proportion of the so-called separation is rather an evidence of incomplete mixing.

Immediately before applying the filler, the faces and ends of the brick in the joint should be thoroughly wet by sprinkling, in order to facilitate the flow of the grout to the bottom of the joints and to provide for forming a complete bond between the filler and brick.

Review of Construction.—Cleveland has arrived at monolithic construction for brick pavements through experience with practically all other types which have been built. We believe that we are getting better and more durable brick pavements thereby.

The extent to which the various types were laid during the past season may be seen as follows:

36 streets—natural sand foundation................	4.81 miles
13 streets—sand or slag cushion on concrete........	4.02 "
75 streets—monolithic (cement-sand and green concrete	10.09 "
	18.92 miles

The monolithic types have been laid upon streets up to 28 ft. in width with entire success.

Best Practice in Concrete Road Construction

By H. ELTINGE BREED,

First Deputy Commissioner, New York Commission of Highways

The title recalls one of the most elated moments of my life. It was when I stood on the rostrum at Prep school to read my essay, "The Best Methods of Becoming a Success"—but there the similarity ends. If I spoke then about all life with conviction, I speak now about concrete roads with circumspection. If I then covered the whole world fearlessly, I now limit my remarks tentatively to New York State, for to dogmatize about best practices in concrete road construction before a body of men like yourselves, would be presumption on my part. What I can tell you that may be of interest, is simply what the experience that we have had in building concrete roads in New York State has led us to believe is good practice at present. That ways of improving it may be suggested is one of my hopes in reading this paper.

First of all, we must prepare the design and specifications.

DESIGN

A standard is almost established for thickness and crown, but it must be kept variable to meet different conditions of sub-soil and density of traffic; if the traffic is to be heavy, the road must be built proportionately thicker.

Grades

Grades are still treated differently in different sections of the country. Our original practice was not to exceed 5%, but today we are building them as high as 8% under certain conditions. Grade seems to be limited only by the ability of the wet concrete to run during the process of construction, by the character of the mix and the kind of traffic to use it. Even on a steep grade, the use of a coarse sand prevents the road from being slippery; and I believe that brooming of the surface facilitates the traction hold of all classes of traffic. Floating should be at a minimum, as this operation brings the finer particles to the surface which gives a smooth top.

Width

Most of the roads we have been building in New York State are 16 ft. in width. This is because when the money was appropriated to build our system, it was on the basis of approximately $13,000 per mi. That was a low figure even at the time, in 1912; at present it is obviously impossible to complete the system as planned then. Only by the strictest economy, by substituting different classes of pavement within certain limits of cost, and by federal aid can we expect to have all of our important roads brought together into a good highway system. It would be far better, however, and ultimately more economical, if we had sufficient funds to build them 18 ft. width. For two lines of traffic on a concrete road 18 ft. should be the minimum width; for three lines 24 ft.

The use of motor vehicles is steadily increasing; they are being built wider and wider. Hence they require pavements where vehicles at least 90 in. wide can constantly and comfortably pass one another. Eighteen feet is probably the narrowest width to allow this. Especially is this true of concrete roads because the transition from the hard concrete surface to the earth shoulder and back again becomes really dangerous in some soils on account of the rut that traffic usually wears along the joining line.

Square-Cornered Edges

In design, the edge of the concrete slab next to the shoulder should be vertical and square cornered. Then if it becomes necessary to reinforce the shoulder with road metal a good joint can be made; and, more important still, if additional widening is required, it can be accomplished with a longitudinal joint of minimum size. We have very satisfactorily widened some miles of concrete roads built throughout the state in accordance with this design by adding 4 ft. or more to one or both sides of the pavement.

Where the soil for the shoulders is unstable we are intrenching it with crushed stone or gravel 4 to 6 in. deep and 1½ to 3 ft. wide. Although this gives good results, and makes for additional safety, still, if much traffic must be turned onto them the maintenance cost of these stone and gravel shoulders is so high as to justify the additional first cost of a wider pavement.

Accidents on 16-Ft. Roads

In order to obviate the danger of accidents on our 16-ft. roads, we have been widening or mooning out the curves, so that in some cases for those of small radius at the center the actual curve is as much as 22 to 24 ft. wide. We have also considered it good practice to give the outside of these curves a superelevation in order to make easier the steering of a car, to lessen the likelihood of skidding, and to insure greater safety in taking these curves at speed. This has been objected to as inducing people to travel round these curves at high speed, but speeding seems to be an inherent mania, unrelated to external conditions, and certain it is that banked curves lessen the casualties resulting from it.

SPECIFICATIONS

Cracking of a concrete pavement is due generally to the unequal settlement of a poor subgrade. If the road is to be satisfactory it is of first importance that a good subgrade be secured. These we consider the essentials of a good subgrade:

1. It must have uniform bearing power.

If an old roadbed is to be used it must be scarified, reshaped and rerolled for the entire width of the pavement, removing all large stone to a depth of 6 in.

2. It must be dry.

Ditches should be low enough to take away the water from under the pavement. With unstable soil good results can be secured by providing sub-drains and spreading a layer of gravel—preferably run-of-bank gravel—over the subgrade to increase its stability. Material used for this purpose must be impervious; if it is porous it will act during wet periods as a reservoir, which, under conditions of frost, will break the pavement proper.

3. It should have metal reinforcement (a) under very bad, i. e., unequal soil conditions; (b) whenever the supporting power of the subgrade changes, as from rock to earth, or passing over a trench.

Our experience indicates that the expense of reinforcement is not justified in gravelly or sandy soils where good natural drainage prevails.

The Mix

The mix should be proportioned in such a manner as to give the greatest density. With our requirements for materials we have found that the proportions of 1:1½:3 most nearly do this. Our specifications provide that the concrete shall be mixed in the proportions of 1 volume of cement to 4½ volumes of sand and broken stone or gravel, and the proportions of fine and coarse aggregate are varied slightly as a result of field void tests so that the greatest density is obtained. Should the size or character of the materials change there would be a corresponding change in the proportioning of the mixture.

The coarse aggregate should consist of a well mixed product of clean No. 1, No. 2 and No. 3 stone or gravel.

No. 1 size is that retained on a ⅜-in. circular screen and passing a ⅝-in. circular screen.

No. 2 size is that retained on a ⅝-in. circular screen and passing a 1½-in. circular screen.

No. 3 size is that retained on a 1½-in. circular screen and passing a 2¾-in. circular screen.

It is provided, however, that not more than 25% of the total shall be No. 1 size, the proportions being so graded as to give a minimum of voids.

Aggregates shoud never be used unless they comply with the tests prescribed.

You may note that we allow, as our maximum size, stone that will pass a 2¾-in. ring, whereas most specifications permit only 1½-in. stone as a maximum. This may seem radical, but our reason for the increase in size is that we get equally as good if not better results from the larger stone, and at a cost decidedly lessened by our using more nearly the product of the crusher. Especially is the price to be considered on contracts where the local supply is crushed on the ground, as is the case in most of our work. If you desire economy, this change is worthy of your consideration. We save 15% in crushing costs by this use of stone larger than the previously accepted standards.

From a practical standpoint a pile of stone graded from ¾ to 2¾ in. has more stability when properly mixed than stone graded from ¾ to 1½ in. In our 1916 work we used stone up to 2¾ in. in size. As an indication of the compressive strength per sq. in. of field cubes tested at an age of 28 days we have a grand average of 3,370 lb. per sq. in. for 504 cubes of stone and gravel, of which only 13¼% were under 3,000 lb. Greater density can be obtained by using stone up to 2¾ in. in size and with the larger size stone there is less probability of spalling at joints and along edges.

Sand

Concrete pavement sand should be such that 100% should pass the ¼-in. screen; not more than 20% should pass a No. 50 sieve and not more than 6% should pass a No. 100 sieve. However, where more than 20% of the sand passes a No. 50 sieve, where it is well graded to give a low percentage of voids and where it conforms to all other requisites, special permission for its use may be given by the chief engineer. Sand may be rejected if it contain more than 5% of loam or silt. All sand to be acceptable should have a compressive strength equal to Ottawa sand when tested in a proportion of 1 part cement to 3 parts sand at the same age, same consistency and using the same brand of cement as for Ottawa sand in the same proportions. It must be free from organic matter and any coating of grains.

Method of Mixing

The concrete should be mixed in approved mechanical batch mixers. Mixing should be continued at a speed of not less than 10 revolutions nor more than 16 revolutions per minute, for at least one minute after all materials are in the drum and before any discharge is made.

If at any time during the progress of the work the temperature is so low that in the opinion of the engineer in charge of the work it will within 24 hours drop to 35° F. the water and aggregates should be heated and precautions taken to protect the work from freezing for at least ten days. Should these temperature conditions persist for two consecutive days, permission should be obtained from the chief engineer before proceeding. He will lay down such requirements of procedure as may be permitted. Such procedure should be only for emergency work. In no case should concrete be deposited on a frozen subgrade.

TESTS

Theoretical tests are fine. They are necessary to tell you what you should have as a final product. You proceed on the hypothesis they offer and then you have to wait until service and climatic conditions prove how far your hypothesis conforms to reality.

Tests for concrete materials have never been given their proper consideration, with the exception of cement which has been tested with all the finesse of the art of testing. In general little if anything has been done on the sands, which have been casually accepted if they looked good or had ever been used before in a structure that would stand up. As for the stone or gravel all kinds and conditions of both have been used with practically no tests at all.

Our work has shown that if we are to omit any of the tests, we might better take a chance with the cement, for of the last 455,000 bbl. used only 1.4% failed to conform to the test of the American Society for Testing Materials. Fifty per cent. of these failures was due to flash set and 50% to failure on the 200-mesh sieve requirement. Had all this cement been used, that rejected for sieve requirement would have given good work, and that rejected for flash set would have been aged enough by the time it was placed in the work to give good results. There has been a far greater proportion of both sand and stone rejected for this kind of work.

Engineering skill presupposes judgment so why not inject it into our problems? After priming ourselves with theory, let us apply it to practice. Let us make field tests that will parallel laboratory experiments; let us conduct our laboratories in such a way that their value may be significant to the man in the field, and so that their results may be checked up by him. Success of work depends upon the field man; in every case his personality helps determine the results. Put him in line with your tests, practices, etc., and his interest and cooperation will show most profitably in the work. All of our men, from the engineer in charge of the road up, are instructed in all the tests and methods of inspection and they complete them on every inspection of the work. We of New York state believe that our best results may be attributed to the esprit de corps engendered by this method.

Field Tests

The principal tests which can be made in the field accurately enough for all practical purposes are:

(1) Gradation Tests for Sand.—Our field men are furnished with sand testers which have the ¼-in., the 20 and the 50 sieves. By using these they can be assured of getting a uniform product from the bank, for they would at once detect any change for the worse in the character of the material and would reject it. Each engineer is supposed to make a daily report of the gradations. A laboratory test, however, is essential to ascertain the presence of any deleterious matter in the sand.

(2) Test for Loam and Silt Content in Sand.—This can be made in the field and checked up by the laboratory results. For the loam test, an excess of water is added to a given quantity of sand in a glass graduate, the whole is well agitated and allowed to stand until the loam and silt have settled on top, when their percentage may be measured.

(3) Test for Set.—This is made by mixing the sand with cement and forming a pat with thin edges. By breaking the edges after 24 to 48 hours it may be determined how the material sets.

(4) Tests for Stone and Gravel.—Field determinations of these materials can be made only for voids. Visual inspection should of course detect soft material and dirty aggregates. Such inspections on the road and at the quarry should be made constantly to know that the material is running uniform and is equal in quality to the original samples. When we realize that nature never has two deposits alike, the importance of these tests in securing good work will be readily appreciated.

Laboratory Tests

Laboratory tests of stone are so familiar to us all that I omit discussion of them here.

For gravel, however, we found that the rattler test in general use did not give a true abrasive value. Because of the rounded structure of the rattler, the first material that was abraded off formed a protective cushion that greatly decreased the subsequent wear upon the stone. To eliminate this condition a new pot of the same size and shape as the standard pot was designed, but it is slotted at intervals to prevent cushioning by allowing the worn-off material to escape. Some of the better known gravels which have proved successful in concrete pavements are used as standards of comparison, with satisfactory results. We have also had promising results in using this pot to test slag, which in the old pot used to act the same as gravel did.

Final Test of the Concrete

Concrete from a batch mix is made up on the road into 6-in. cubes, two in number, from every 500 cu. yds. of material. They are cured for 21 days in moist sand and then shipped into the laboratory and tested at 28 days. The results of these tests are given to the engineers on the work and the rivalry to have the highest test value produces good results. It is expected that these cubes will go over 3,000 lb. per sq. in. compression, and if they don't we look for trouble. Of 504 cubes tested in 1916 only 13¼% were below 3,000 lbs. and the determination of the defects were as follows:

	Per Cent.	
	1916	1915
Coarse aggregate coated	61.9	35.0
Fine aggregate containing an excess of loam or made up of excessively fine-grained sand	25.7	43.9
Coarse aggregate, poor quality	6.2	8.2
Poor manipulation in making cubes	6.2	16.9

These tests also show a grand average of 3,370 lb. compression for all 1:1½:3 mix cubes stone and gravel, while the average for the stone cubes is 3,380 lb. and the average for the gravel cubes is 3,080 lb. Thus it is demonstrated from these tests that stone concrete is 11% stronger than gravel concrete. In comparing the two, it is fair to say that all gravels with a coating that ordinary washing will not remove should be rejected. While stone that retains much of the dust of fracture is bound to make weak concrete, this is especially true of all soft limestones, and of any stone that is crushed when it is wet.

CONSTRUCTION

An exact subgrade is necessary to save the concrete that would be wasted in evening up inequalities in the foundation.

The extra time and attention spent on getting an exact subgrade will be well repaid.

The materials should be placed well in advance of the laying, so that when the mixer has once commenced operations the work may be continuous. If the road is being constructed of imported materials, the use of a stock pile to prevent shortage will materially reduce the loss from delays in operation. In order that the minimum amount of work may be done in taking materials from the subgrade and placing them in the mixer, it is advisable that the superintendent and foreman should each have a list of the amounts to be distributed for every hundred feet. A little attention to this detail will save largely in the item of labor.

Rejection of Materials.—Materials should be rejected before they are unloaded to come on the work. As good quality is essential in both sand and stone, both these materials should be checked up from day to day in order to secure the best results.

Equipment.—Attention should be given to the screed or strike board or template as it is often called. This should be heavy enough to screed the concrete properly, and it should be cut to conform to the crown of the road. It should be provided with handles and be shod with a steel angle-iron, bent to the shape of the roadway. Wooden floats should be provided for doing the necessary floating, and the float to be used at a joint should be split in such a manner that it will ride over the joint smoothly and will cover an area of at least 1 ft. on either side of the joint. Steel forms, while more costly than those of wood, are far more economical in the long run and pay for themselves in a short time.

Measuring barrows should be of such a type that their measurement can be regulated by the bolting of boards across the rear part of the barrows to make the quantities adjustable. Forks should be provided for taking the stone from the subgrade in order to eliminate the dirt.

To insure a sufficient supply of water a pipe line should be installed, for although tank supply may amply provide the mixer, it can scarcely take care of that and attend to sprinkling too.

The concrete road presents a good problem for the application of labor saving devices in the handling of materials, and many different installations have shown reasonable cost reductions. The industrial railroad has played a large part in this.

The forms should be placed in such a way as to give them stability and they should, above all, be tight. The subgrade should be kept drenched with water immediately ahead of the laying of the concrete.

An ordinary concrete force in operation on a 16-ft. road is comprised of from 32 to 35 men, doing all branches of the work; and it is quite often necessary to rearrange the gang so that the best results may be secured in keeping the mixer in continuous operation.

Suitable measuring tanks should be provided so that the amount of water may be such as to make the separate batches of the same consistency, the ideal consistency of concrete being such that it will just settle and will not run. This is very important as the density of the resulting concrete is dependent upon it; if too wet the materials will run on the grades.

The concrete should be well spaded and kept high above the screed or strike board on the mixer side. Tamping should not be allowed. In screeding, the screed should be slowly pulled back and forth, advancing it slowly with each operation. When approaching a joint the screed should be brought up to the joint and carried back in order that the surface may be uniform. No more floating than is absolutely necessary should be resorted to, as the primary object is to have the wear on the surface taken by the stone and not by the thin mortar layer produced by floating.

Joints should always be perpendicular to the surface of the pavement. If they are not, in subsequent expansion there is often riding of the slabs. In many instances it may be necessary to stiffen up the consistency of the concrete in order that the screeding on grades will not give a ridgy effect. If possible, all work on grades of over 4% worked up hill. The cement factor should be taken daily and reported to the division engineer.

Curing properly is as necessary as good construction, for upon this depends to a large extent the strength of the resulting concrete. Sprinkling should be commenced as soon as the surface will not pit and a cover of 2 in., at least, of sand or loam should be spread over the surface. This cover should be kept saturated with water for ten days. Care should be taken, however, not to place cover until the concrete is sufficiently firm to withstand the impact caused by placing. Sprinkling should be done in such a manner as not to wash the cover from the surface. When the temperature gets below 50° F. in the middle of the day, sprinkling and cover may be omitted. When concrete is laid in cold weather its curing period should be lengthened, as low temperature retards its gain in strength. Work done in November should be allowed to cure from four to six weeks.

It has been our aim to designate essentials in design and specifications; to hold only such standards as have been proven practical, from our field and laboratory tests; and to employ only such methods of construction as will insure serviceable pavements at the lowest possible cost.

As you are aware, I have not attempted in this paper to cover the subject fully. Limitation of time, to say nothing of other limitations, would not allow that. I have tried to suggest features which may sometimes lack sufficient attention, and to emphasize other features of whose importance we feel certain. In conclusion let me say that the ideas presented in this paper are based upon such knowledge as may be gained by inspection of concrete pavements in various parts of the country, and, more validly, on the actual construction in New York State of 201 mi. of second-class concrete pavement, 1:2½:5 mix, a type which we have ceased using; and upon the actual construction of 364 mi. of cement concrete pavement, 1:1½:3 mix, built in the last four seasons. There still remain 127 mi. of this type of construction under contract in New York.

A Bridge Costing $800,000 will be built across the bay at St. Louis, Miss., the coming spring by the Mississippi Bridge and Turnpike Co., according to a report.

Pawpaw District of Marion County, West Virginia, has changed the date of the special election at which voters will decide upon the question of a road bond issue of $330,000 to Feb. 14, by order of the County Court.

The Board of Supervisors of Peoria County, Illinois, have called an election for April 3 to give the citizens of the county a chance to vote on a proposed $1,700,000 bond issue for road improvement purposes.

Outagamie County, Wisconsin, is continuing road construction under the $700,000 bond issue voted last year. It has been advertising for bids on approximately 45 mi. of concrete roads. A number of counties in Wisconsin are actively promoting the question of bond issues for road improvement.

The Board of Supervisors of San Francisco, Cal., recently accepted the offer of the State Harbor Commission to build a roadway along the Embarcadero for the operation of motor buses. The city is to have the exclusive right to operate the buses, with transfer privileges on municipal street cars. The roadway will be 30 ft. wide.

Cook County, Illinois, Will Build 80 mi. of Road this year with the money remaining from the $2,000,000 bond issue passed last year. Alternate bids will be asked on concrete, asphaltic concrete on concrete base, and asphaltic concrete on macadam base, for all of the contracts to be awarded. Contracts for two roads will be let each week until all the work has been let, according to a report.

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Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

FEBRUARY 10, 1917

CITY MONEY FOR COUNTRY ROADS

When a road is built from a city or town out into the surrounding country it manifestly benefits both the urban and rural areas it serves. It is almost as obvious that the benefits extend to other cities and towns and to other rural districts—some perhaps at long distances from the road.

To illustrate the point consider the effects of building a system of roads radiating out from a shipping point through a productive agricultural area in almost any state in the more densely populated section of the country. The roads will enable the farmers to get their produce to market at less cost—in some cases it may be possible to market fruit or vegetables that previously had been allowed to rot in the orchards and fields because it did not pay to attempt to transport them over poor roads. It is quite probable, too, that the improved transportation facilities will make it profitable to cultivate land that has lain idle before, to keep larger herds and flocks, and to install new equipment making for increased production and decreased operating expenses.

So much for the farmers—the producers in the rural district opened up. What of the people of the city? If the farmers can get to town quickly and comfortably, they will trade there. The retail tradesmen in every line will do a larger business than before and the volume of their business will increase as the prosperity of their customers is enhanced. The banks will do more business, the post office receipts will be larger, and a greater volume of freight will be brought into and sent out from the town by rail. All these will mean greater prosperity for the town and its people.

In addition, other than purely material advantages may reasonably be expected to follow road improvement, for it will make it easier for the town dwellers to get into the country and for the country people to take advantage of the educational, social and religious advantages offered by the institutions of the town. The consolidation of public and high school plants, with an accompanying increase in efficiency, may be possible in many cases. Larger and better churches, as well as schools, may come. People living in the town may be enabled to move to the more healthful and pleasanter suburbs.

And the influence of the improved roads will not be limited to the one town and the adjacent country districts. Large cities at considerable distances will share in the benefits—to a lesser degree, of course, but sometimes very materially. Their markets will be brought into closer touch with the producers on the farms and their manufacturers and merchants will gain through greater sales in the rural community served by the roads. Such benefits can even now be traced for comparatively long distances and they will become more and more apparent with increases in the mileage of improved roads and the growth of the motor truck as a factor in primary transportation.

With these facts clearly in mind it is easily seen that the interests of the cities and towns as well as justice to the country districts demand that the former should pay a part of the cost of rural road work. Few strictly farming communities can afford to bear the entire burden, and if they were financially able to do so, such an assessment of the cost would not be fair.

Where financial aid is given by the state to local units, cities and towns do contribute to rural road work. Similar conditions prevail to a considerable extent in many counties. Such distribution of the burden of meeting the cost of good roads is correct in theory, but the application of the principle is crude. A part of the cost of improving the roads in any city, town, county or state ought to be borne by each individual in that city, town, county or state. Carried to the logical conclusion the same reasoning applies to the whole country—each citizen should bear a certain portion of the cost of all road betterments. Such a distribution, however, is impossible, as the problems involved are too intricate and contain too many variables. But more equitable apportionment of the cost than any yet made is entirely possible, and the study of the matter is one which road builders are peculiarly fitted to undertake.

The problem is one of the most important in the economics of highway improvement. And it is one in which, to the present, very little progress has been made.

NEWS NOTES

A $50,000,000 Bond Issue in Pennsylvania is proposed by a prominent advocate of the good roads movement in that state.

The Construction of Parkhill Boulevard, San Francisco, Cal., at a cost of about $224,000, has been decided upon by the City Supervisors, according to a report. It is stated that the boulevard will open up a section containing a population of about 25,000, at present with direct transit facilities connecting it with the downtown district. It is also stated that the city will pay $120,000 for grading and paving, and the remaining $104,000 will be paid by the property owners for rights of way.

Bourbon County, Kansas., which is 90 mi. south of Kansas City, has a system of rock road construction radiating in seven directions from Ft. Scott, the county seat. According to information received from the Chamber of Commerce of Ft. Scott, the county now has 50 mi. of permanent macadam road, built under an act of the Kansas Legislature, forming a special road district and levying a 1-mill tax which has produced $16,000 annually. The mileage has been constructed during the past ten years, at the rate of 4 or 5 mi. a year. During 1915 petitions were circulated for over 50 mi. more of macadam road, and during 1916 contracts for 27 mi. of rock road were let by the county commissioners. These contracts for road construction in Bourbon County, under the Hodges road law, exceed the amount contracted for during the same time under the same law in all the rest of the state. Petitions for 30 mi. additional will be completed and filed at an early date.

Fourteenth Annual Convention of the American Road Builders' Association

The Seventh American Good Roads Congress, embracing the fourteenth annual convention of the American Road Builders' Association and the Eighth National Good Roads Show, opened at 11:00 a. m., Tuesday, Feb. 6, at Mechanics Building, Boston, Mass. President A. W. Dean, Chief Engineer of the Massachusetts State Highway Commission, presided.

The proceedings of the first day included the formal opening session in the forenoon, devoted to addresses of welcome and the response by President Dean, and the afternoon session at which the technical work of the meeting was commenced.

TUESDAY, FEB. 6, 1917.

First Session

President Dean called the opening session to order at 11:00 a. m., introducing as the first speaker Governor Samuel W. McCall of Massachusetts. In a very brief speech the Governor welcomed the convention to the state and touched briefly upon the importance of the work of the meeting. He said that building good roads was one of the really great works that have to be done, that it was as important as any of the work being carried on by public officials. The people of a state, town or city, according to Governor McCall, should be required to build their own local roads, but this work should be supplemented by the national government in order to provide good trunk lines.

Col. Wm. D. Sohier, Chairman of the Massachusetts State Highway Commission, followed Governor McCall. He extended to the delegates and visitors a welcome on behalf of the Commission and spoke at some length on Massachusetts methods of road betterment and the results accomplished. He also called attention to the comparatively small number of set papers included in the program and the resulting opportunity for discussion, always such a valuable part of the proceedings.

The next speaker was Chas. F. Weed, President of the Boston Chamber of Commerce, who very briefly welcomed the convention on behalf of that organization.

Mayor James M. Curley of Boston spoke next, extending the greetings of the city and welcoming the convention. In the course of his address he expressed his belief in federal aid for road building, and said that he was in favor of liberal appropriations from the national treasury for that purpose. He also sketched briefly the work done and to be done in the improvement of Boston's streets.

George W. McNear, President of the Massachusetts State Automobile Association, welcomed the delegates on behalf of the automobilists and referred briefly to the interdependence of motorists and road builders.

The last address of welcome was made by John M. Keyes, Vice President of the Massachusetts Highway Association, who also explained in some detail the arrangements that had been made by various local organizations and committees for the entertainment of delegates and guests.

President Dean responded for the A. R. B. A. to the welcome extended to it, thanking the local committees for the work they had done. He said that although it was customary for the president to make a presidential address at the opening session, he would not read his, but hand it to the Secretary to be printed in the official "Proceedings."

Geo. W. Tillson, Consulting Engineer to the President of the Borough of Brooklyn, New York, and a past president of the A. R. B. A., then offered the following resolution:

"Resolved: That in this momentous international crisis the members of the American Road Builders' Association, in convention assembled in the City of Boston, February 6, 1917, believe that the honor of the country must be maintained at any cost, and that they unanimously approve of the recent action of the President of the United States and pledge to him their full support."

Mr. Tillson moved that the resolution be adopted and that it be telegraphed during the afternoon to President Wilson. C. A. Kenyon, of Washington, D. C., seconded the motion and it was carried unanimously.

Following this action, President Dean announced the appointment of committees as follows:

Committee on Resolutions: J. W. Hunter of Pennsylvania, Chairman; Paul D. Sargent of Maine; Geo. W. Tillson of New York; G. R. Ramsey of Florida; C. A. Kenyon of the District of Columbia; S. C. Lancaster of Oregon; F. E. Everett of New Hampshire; Charles W. Gates of Vermont; Col. E. A. Stevens of New Jersey; F. B. Dunn of Ohio, and W. A. McLean of Ontario, Canada.

Committee on Credentials: R. A. Meeker of New Jersey, Chairman; R. H. Gillespie of New York; F. E. Ellis of Massachusetts; R. Keith Compton of Maryland, and W. T. Headley of Pennsylvania.

Second Session

The second session of the convention—the first for the presentation and discussion of technical papers—was called to order promptly at 2:00 p. m., by President Dean, who with Past President Tillson, presided during the session.

The first paper entitled "Policy and Program of Government in Road Construction Under the New Federal Aid Law," was presented by Logan Waller Page, Director of the Office of Public Roads and Rural Engineering, U. S. Department of Agriculture. A spirited discussion followed in which L. D. Smoot, of Jacksonville, Fla., F. A. Reimer, County Engineer of Essex County, N. J., and J. M. Head, of Boston, took part.

The second paper of the afternoon, "Earth and Gravel Road Maintenance," by R. L. Morrison, Professor of Highway Engineering at the Agricultural and Mechanical College of Texas, was read, Prof. Morrison not being present. The reading of the paper was followed by an interesting discussion participated in by F. E. Everett, State Highway Commissioner of New Hampshire; S. B. Bates, State Highway Commissioner of Vermont; C. A. Kenyon, of Washington, D. C.; A. C. Innis, Supervisor of Repairs, Connecticut State Highway Department; Philip P. Sharples, Manager General Tarvia Department, The Barrett Co.; Wm. C. Johnson, of Newtown, Conn.; George Hogarth, Chief Engineer, Department of Public Works, Province of Ontario, Canada; O. M. James, Division Engineer of the New Hampshire State Highway Department; Paul D. Sargent, Chief Engineer of the Maine State Highway Department, and Wm. E. McClintock, a member of the original Massachusetts State Highway Commission. The discussion lasted until late in the afternoon and brought out many valuable and interesting experiences in earth and gravel road maintenance.

Entertainment

A reception in the form of an entertainment and smoker was given the delegates at Convention Hall, corner of Garrison and St. Botolphe Sts. by the Massachusetts Highway Association at 7:30 P. M. Those in charge of arrangements were Wm. E. McClintock, Michael Driscoll of Brookline, George E. Stuart of Newton, Fred H. Clark of Springfield, Ransome Rowe of Boston, and W. E. Hassan of Worcester, Mass.

A program of entertainment was arranged for visiting ladies for Wednesday afternoon and evening which included a luncheon given by the Ladies' Committee at the Woman's City Club, and an afternoon tea at the William Filene restaurant, and in the evening a theater party at the Shubert Theater through the courtesy of Mayor James M. Curley.

Machinery Exhibit

A comprehensive exhibit of improved road machinery and materials constituting the Eighth National Good Roads Show was shown in connection with the convention. The exhibit, which included the most up-to-date types of motor-driven vehicles, occupied the upper and lower floors of the building.

WEDNESDAY, FEB. 7.

Third Session, 10:00 a. m.

The entire morning of Wednesday was devoted to the subject of "Bituminous Roads and Pavements and Treatments," and the session proved an intensely interesting one. Wm. R. Farrington, Division Engineer of the Massachusetts State Highway Commission, presented a paper in which he treated the subject under two general heads—construction and maintenance. Under bituminous concrete construction he referred specifically to sheet asphalt, broken stone and bituminous surfaces or pavements, and bituminous gravel roads, but devoted more time to the details of sand and oil road construction, in which his work in Massachusetts has given him a large experience. Under the head of bituminous macadam, he described broken stone penetration work, and the method used in sand and oil layer work, referring briefly to bituminous surface treatment. His remarks on maintenance were devoted chiefly to bituminous surface treatment of waterbound macadam and gravel roads.

The various points emphasized in the paper brought out a lively discussion, which was participated in by Paul D. Sargent, and other highway officials and authorities. They included F. E. Everett, State Highway Commissioner of New Hampshire; L. R. Grabill, Superintendent of Suburban Roads, District of Columbia; Robert A. Meeker, State Highway Engineer of New Jersey; George W. Tillson, Consulting Engineer to the President of the Borough of Brooklyn, New York, N. Y.; A. T. Rhodes, Street Commissioner of Worcester, Mass.; Arthur H. Blanchard, Professor of Highway Engineering, Columbia University, New York, N. Y.; Michael Driscoll, Street Superintendent of Brookline, Mass.; A. C. Innis, Supervisor of Repairs, Connecticut State Highway Commission; D. R. Kane, Assistant Superintendent of Repairs, Connecticut State Highway Commission.

Fourth Session, 2:00 p. m.

At the fourth session of the convention a paper entitled "Best Practice in Concrete Road Construction" was presented by H. E. Breed, First Deputy Commissioner of the New York State Commission of Highways. The reading of the paper, which is printed in full in this issue (page 99), called forth the valuable expression of a number of highway officials and others identified with the road building world. Prof. Blanchard led the discussion and was followed by W. T. Chollar, Manager, Highway Department, Atlas Portland Cement Co.; J. A. Johnston, Division Engineer, Massachusetts Highway Commission; S. F. Butler, of the Portland Cement Association; Nelson P. Lewis, Chief Engineer of the Board of Estimate and Apportionment, New York, N. Y.; H. W. Durham, Consulting Engineer, New York, N. Y., and formerly Chief Engineer of Highways, Borough of Manhattan, New York City; A. C. Innis, and Charles M. Upham, Chief Engineer, Coleman du Pont Road.

Dinner, 7.00 p. m.

The annual A. R. B. A. dinner was held at the Hotel Copley-Plaza Wednesday evening, as announced.

An account of the remaining sessions of the convention will appear in next week's issue of "Good Roads," Feb. 17.

New Motor Truck Law Passed in New York State

The Hewitt-Wells motor truck tax bill which recently passed both houses of the New York legislature was signed by Gov. Whitman on Jan. 30 and at once became a law. Owners of motor trucks and motor omnibuses must now pay a new schedule of fees varying from $15 to possibly $70 per year, approximately $600,000 additional revenue thereby accruing to the state. A condensed schedule of annual fees for motor vehicles used as passenger omnibuses, according to seating capacity, follows:

Five passengers or less	$15.00
Not less than 6 nor more than 7	24.50
Not less than 8 nor more than 10	30.50
Not less than 11 nor more than 16	43.00
Not less than 17 nor more than 20	52.00
Not less than 21 nor more than 22	55.00
Not less than 23 nor more than 26	61.50
Not less than 27 nor more than 30	67.50
More than 30 ($2 for each additional passenger)	67.50

"Provided that if any such motor vehicle used as an omnibus for the transportation of passengers, and for which a fee is herein provided, is originally registered after Aug 1 in any year, the register fee for that year shall be one-half of the fee herein provided for such motor vehicle; and provided further that upon the registration or reregistration of any omnibus mentioned herein the number plates to be issued therefor shall, upon the payment of an additional fee of $2 for each omnibus, be the same in form as is issued for passenger motor vehicles which are not omnibuses."

"The foregoing schedules shall not apply to omnibuses operated pursuant to a franchise other than a franchise express or implied in articles of incorporation over streets designated in said franchise wholly within the municipality, and for any such omnibus, without regard to the seating capacity, the annual fee shall be $10; but if any such omnibus shall be also operated outside of the municipality then the foregoing schedule of fees shall apply thereto; and provided further that if any such omnibus for which a $10 fee is herein provided is originally registered after Aug. 1 in any year the fee for that year shall be one-half the fee herein provided for such omnibus."

The annual fees for motor vehicles "commonly known as auto trucks, used for the transportation of goods, wares and merchandise," on a basis of combined weight of truck and carrying capacity are shown in the following condensed schedule:

Two tons or less	$10.00
More than 2 and not more than 3	15.00
More than 3 and not more than 4	20.00
More than 4 and not more than 5	25.00
More than 5 and not more than 6	30.00
More than 6 and not more than 7	35.00
More than 7 and not more than 8	40.00
More than 8 and not more than 9	45.00
More than 9 and not more than 10	50.00
More than 10 and not more than 11	55.00
More than 11 and not more than 12	60.00
More than 12 and not more than 13	65.00
More than 13 and not more than 14	70.00
More than 14 (and each ton in excess, $10)	70.00

The law provides, however, that if the vehicle is originally registered after Aug. 1 in any year, the register fee for that year shall be one-half the regular fee for the year.

Students of Ceramic Engineering at the University of Illinois will be aided in their work by the use of one of the latest types of rare metal LeChatelier pyrometer outfits which has been lent indefinitely to the University by the Taylor Instrument Companies of Rochester, N. Y.

The Issue of $260,000 Road Bonds in Wasco County, Oregon, authorized at the November election, have been sold and bids for construction will be asked in the near future. Bids for work under the $80,000 road bond issue of Wheeler County have been called for Feb. 19.

Bituminous Surface Treatments on Park Roads in Portland, Maine

By WM. J. DOUGHERTY

From an investment standpoint as well as from a consideration of general satisfaction given, the roadways of the City of Portland, Park Department, are illustrative of the benefits which may be gained from a little timely repair maintenance and systematic road oiling.

The first oiling by the department was begun about 1910 and it has been continued each year following. It is surprising to see the well preserved sections of common earth roads which have resulted from these successive oil applications.

The original construction of the treated roadways was of earth, gravel, water bound macadam, and in 1910 a surfacing of "Apposite" pavement—bituminous concrete surfacing on a cement concrete base—of which approximately 13,000 sq. yds. was laid by the Hassam Co. on sections of the Eastern Promenade and the Western Promenade.

During the summer season of 1916, about 25,000 sq. yds. of roadways received a hot oil application of approximately 1/5 gal. per sq. yd. of 65% asphalt base oil. All "Apposite" pavement, which, since laying had received no surface treatment, was squeegeed with 270 penetration asphalt (Texaco special binder) heated to about 350° F., and applied by heavy rubber squeegees at the rate of .25 gal. per sq. yd. of pavement. The surface had become slightly pitted under traffic and, after thoroughly sweeping with fiber brooms, it furnished an ideal surface for a bond with the bituminous material. The bituminous material was then covered with coarse, sharp sand. As the traffic on these sections is almost wholly motor pleasure traffic, this treatment should suffice for some time to come.

Previous to the application of the hot oil to the macadam and soft road sections, it was necessary to repair a few potholes which had developed during the time which elapsed since the last treatment in 1915. For the most part, a hot mixed bituminous gravel was used for the patches. The gravel was heated and hand mixed with some of the asphalt used for the squeegee treatment. Some patches were also made by cutting this asphalt with about 40% of commercial naphtha and after the cut-out areas were filled with fresh gravel and rolled thoroughly, this cut asphalt was applied and it quickly permeated the patches. After volatilization of the naphtha, the patches appeared very firm.

The hot oil was applied by pressure from a motor truck of approximately 1,000 gal. capacity. The oil and truck were furnished by the Standard Oil Co., which company received so much per gallon for the oil applied. The oil was then covered with coarse sand in quantities just sufficient to prevent a nuisance to passing vehicles. There was a slightly noticeable tendency in some areas which had received successive oil applications from year to year, to push under traffic in hot weather. This has, the writer believes, been characteristic of oil applications in other districts, and in some places oil applications are giving way to applications of materials less susceptible to this tendency to push in hot weather.

The above work was done under very good conditions of weather, and this, in itself, goes a great way towards ultimate success in bituminous surface treatment.

Road Activity in Santa Clara County, California

The Board of Supervisors of Santa Clara County, California, on the endorsement of the San Jose Chamber of Commerce and other prominent organizations and individuals, has decided to call an election within the next few weeks to vote on the $1,500,000 bond issue which has been proposed for the building of 82 mi. of new concrete roads, and the work of grading and building bridges on about 100 mi. of road in the county. The roads upon which it is proposed to use the money derived from the sale of the bonds, if the issue is approved, are shown in the subjoined table. Except where otherwise specified, the work consists of laying cement concrete pavement.

Location of Road.	Mileage.	Cost.
Stanford, Los Altos, Fremont, Homestead	13	$156,000
Middlefield extension to Sunnyvale	8	32,000
Saratoga Summit (grading, drainage and bridges)	..	65,000
Saratogo to Los Gatos	3½	40,000
Los Gatos and Campbell	3½	40,000
Los Gatos, Almaden, Harwood, Branham to Almaden	5½	70,000
Almaden Ave. to Almaden, McKean, Uvas, Watsonville to Bodfish (grading, drainage, bridges)	4	67,000
Bodfish road	4½	54,000
Bodfish Mill canyon, grading, drainage and bridges	....	26,000
Leavesly Road to New Ave	2½	28,000
New Ave. to Rucker, Foothill to Maple, Hill to Cochran, Cochran to Monterey Road (grading, drainage, bridges)	13	32,000
San Martin Ave. to Foothill, with bridges	1½	21,000
Tennant Ave. to hill (grading, drainage and bridges)	2½	10,000
Dunne Ave. to hill	2	24,000
Watsonville to Llages bridge	2	24,000
Hillsdale Ave., Monterey Road to Almaden	2	24,000
San Carlos St., Race St., to city limits	½	8,000
Meridian, Hamilton and Infirmary	1¾	22,000
Stockton Ave. via University to Alameda	1¼	15,000
Santa Clara and Saratoga Ave	2	24,000
Santa Clara and Alviso road	3¼	40,000
Montague Road	1⅛	20,000
Piedmont extension	3	36,000
Penitencia Creek	3	40,000
Toyon, Fleming and Norwood	8¼	100,000
Mt. Hamilton Road (grading, drainage and bridges)	22	88,000
King road, Berryessa to Story	3	36,000
White road, Alum Rock and Tully	3½	45,000
McLaughlin—McKee and Loupe	4¼	50,000
Gish Road	1⅛	15,000
McKee to bridge	1	12,000
Alum Rock Ave. to 26th St	1	12,000
Berryessa, 13th St. to creek	½	6,000
Pacheco Pass Road (bridges and parks)		150,000
Total		$1,500,000

Would Improve Erie-Pittsburgh Highway

A movement to secure the improvement of the Erie-Pittsburgh highway in Pennsylvania has been actively started following the efforts of a number of interested persons who for sometime have labored to bring it about. On Feb. 6 more than one hundred and fifty representatives of Alleghany, Butler, Lawrence, Mercer, Crawford and Erie counties, including Mayor Miles B. Kitts, of Erie, and F. I. Gellmar, of Pittsburgh, visited Harrisburg and placed the matter before Gov. Brumbaugh and State Highway Commissioner Black.

In an address the Governor expressed himself as favoring the improvement of what he considered a very important main highway. Commissioner Black in a speech agreed that the Erie-Pittsburgh road should be built at the earliest possible moment, and referred to a table of appropriations to show how much money would be available on each million dollars of an appropriation made to the department for road construction in the counties through which the road would pass, adding that these figures showed that it would be necessary either to increase the appropriation which the Department asks from the 1917 Legislature four times or else to get the cooperation of the counties affected. This could be done, he explained, if each county would contribute an amount equal to the amount which the State Highway Department would apportion that county. This would leave a balance of a few hundred thousand dollars which, he believed, the citizens of Erie and Pittsburgh would be glad to contribute.

Senator Eyre, of Chester County, Chairman of the Senate Committee on Public Roads and Highways, stated that his county had been one of the first to contribute for state highway construction and urged the advocates of the Erie-Pittsburgh highway to form an association and to raise contributions to meet the state in the construction of the road.

MEETINGS

Calendar of Coming Meetings

February 7-15.—Tenth Chicago Cement Show—Coliseum, Chicago, Ill. Secretary, Blaine S. Smith, 210 South La Salle street, Chicago, Ill.

February 8-10.—American Concrete Institute—Annual meeting, Hotel LaSalle, Chicago, Ill. Secretary, Harold D. Hynes, 1418 Walnut Street, Philadelphia, Pa.

Feb. 9.—Texas Town and City Planning Association.—Semi-annual convention, Sherman, Tex. Secretary, J. E. Suratt, Sherman, Tex.

February 13-14—Pikes Peak Ocean to Ocean Highway Association—National annual convention, St. Joseph Mo. Secretary, A. W. Henderson, Colorado Springs, Colo.

February 19-24.—Southwestern Concrete Association—Annual meeting and show, Kansas City, Mo. Chairman of committee, Charles A. Stevenson, 1433 West 10th St., Kansas City, Mo.

March 5-6—National Paving Brick Manufacturers' Association—Annual convention, Hotel McAlpin, New York, N. Y. Secretary, Will P. Blair, Cleveland, Ohio.

March 5-7—American Ceramic Society—Annual meeting, Hotel Astor, New York, N. Y. Secretary, Edward Orton, Columbus, O.

April 17-20.—U. S. Good Roads Association.—Fifth annual convention, Birmingham, Ala. Secretary, J. A. Rountree, 1021 Brown Marx Building, Birmingham, Ala

Ontario Good Roads Association

The annual meeting of the Ontario Good Roads Association will be held in the York County Building, Toronto, Ont., Feb. 27-29. The chief subject of discussion at this meeting will undoubtedly be the proposed legislation for a provincial system of highways.

The annual conference of County Road Superintendents and Engineers will be held in the Parliament Buildings, Toronto, March 27-30.

American Concrete Pipe Association

The annual convention of the American Concrete Pipe Association will be held at the Auditorium Hotel, Chicago, Ill., on Monday, Tuesday and Wednesday, Feb. 12, 13 and 14, respectively. Registration of members and visitors will begin at 11.00 a. m. Monday. At 2.00 p. m. President G. F. Lillie will formally open the convention, the afternoon being occupied with the reading of papers and the appointment of committees, followed by a dinner at 6.30 p. m.

On Tuesday, Feb. 13, two papers of interest to road builders will be presented: "New Drain Tile Specifications of the American Society for Testing Materials," by George P. Diekmann, Chief Chemist, Northwestern States Portland Cement Co., Mason City, Ia., and "Supporting Strength of Drain Tile in Ditches," by W. J. Schlick, Drainage Engineer, Iowa State College, Ames, Ia.

Committee reports will be presented on Wednesday morning. In the afternoon a business section will be held, and other papers read. The secretary of the Association is E. S. Hanson, 538 South Clark St., Chicago, Ill.

American Concrete Institute

The thirteenth annual convention of the American Concrete Institute opened at the Hotel La Salle, Chicago, Ill., on Feb. 8 and will close today. The three-day program includes a number of technical and other papers, and reports of the various committees. Some of the papers scheduled for presentation were the following:

"Slag and Cinders as Aggregates," Sanford E. Thompson, Consulting Engineer, Boston, Mass.; "Essentials for the Successful Construction of Concrete Highways," Wm. M. Acheson, Division Engineer, New York State Highway Commission; "Condition of the Wayne County Roads," A. N. Johnson, Consulting Engineer, Chicago, Ill.; "Experience in Construction and Maintenance of Concrete Highways in California," Austin B. Fletcher, State Highway Engineer of California; "Maintenance of Concrete Roads in Connecticut," W. Leroy Ulrich, Superintendent of Repairs, Connecticut State Highway Commission; "Some Recent Developments in the Construction of Concrete Roads," W. M. Kinney, Universal Portland Cement Co.; "Lessons from Culvert and Bridge Failures," Thomas H. MacDonald, Highway Engineer, Ames, Ia. Scheduled for today are reports of the Committee on Reinforced Concrete Highway Bridges and Culverts, the Committee on Concrete Aggregates, the Committee on Sidewalks and Floors, and the Committee on Nomenclature.

The date of the fifth annual convention of the United States Good Roads Association is April 17 to 20, inclusive, instead of February 17 to 20, as noted in the issue of January 27.

NEWS NOTES

The Philadelphia Board of Trade Urges the Broadening of Locust Street by means of a $4,000,000 loan to be passed upon at a forthcoming election.

The Dixie Highway in Butler County, Ohio, will be paved with brick, the work to be started this spring, according to a recent report.

Fisher County, Texas, Has Called An Election for February 17 to vote on a bond proposal of $100,000 for road purposes, according to a report.

The Allentown-Bethlehem Highway in Pennsylvania is being surveyed preparatory to improving a 5-mi. section of the road with pavement similar to that used on the Bethlehem and Easton Road which was completed last fall.

The Board of County Commissioners of Muskogee County, Oklahoma, has decided to call a special election on March 6, 1917, to decide upon the proposed $1,000,000 bond issue for road and bridge construction in that county.

The Municipal Bridge Across the Mississippi River at St. Louis, Mo., was formally opened on Jan. 20. The bridge provides for both highway and railway traffic, the upper, or highway deck, with approaches being 9,797 ft. in length, and the lower deck with approaches, 18,258 ft. The latter is 115 ft. above low water mark.

According to a report of the California State Highway Commission recently filed with the Governor of the State, the following State mileages have been constructed by the Commission under the $18,000,000 bond issue: Concrete base, thin bituminous covering, 941.88; concrete base, Topeka surfacing, 18.08; concrete base, asphalt surfacing, 5.41; macadam, Topeka surfacing, 16.54; macadam oiled, 158.45; asphaltic concrete, 10.37; graded only, 410.65; making a total of 1,562.23 miles.

PERSONAL NOTES

H. J. Hanmer has been reappointed City Engineer of Gloversville, N. Y.

R. L. Cavanaugh has been reappointed City Engineer of North Bend, Ore.

J. W. Mercer has resigned as County Engineer of Lucas County, Iowa, and has been apointed Engineer of Ringgold County, with headquarters at Mt. Ayr, Ia.

George Freis has been appointed County Engineer of Iowa County, Iowa, with headquarters at Marengo. He succeeds Byron Goldthwaite, resigned.

F. D. Pearse has been appointed County Engineer of Franklin County, Iowa, with headquarters at Hampton. He suceeds A. G. Baker, resigned.

H. W. Vetter, formerly Assistant County Engineer of Warren County, New Jersey, has been appointed County Engineer of that county.

C. B. Voorhis has resigned as Vice President of the Oakland Motor Company to become head of the selling division of the Nash Motors Company of Kenosha, Wis.

Malcolm B. Parlin has been appointed County Engineer of Leavenworth County, Kansas, with headquarters at Leavenworth. He succeeds W. V. Thomas.

Charles M. Upham, Chief Engineer of the Coleman du Pont Road, has been appointed County Engineer of Sussex County, Delaware, with headquarters at Georgetown.

John E. Williams has been appointed County Engineer of Shawnee County, Kansas, with headquarters at Topeka. He was formerly County Surveyor of Pottawatomie County.

C. L. Kinney, formerly City Engineer of Elkhart, Ind., has been made County Engineer of Elkhart County, succeeding A. L. Reith, who has formed the Reith Construction Co., at Goshen, Ind.

J. R. Morrison has severed his connection with the Engineering Department of King County, Washington, to enter private practice. He has opened offices in the White Building, Seattle, Wash.

Capt. G. E. Edgerton, Corps of Engineers, U. S. A., has been assigned to the Second Regiment of Engineers in Mexico. Since July, 1916, he has been stationed at El Paso, Tex., in charge of the engineering depot.

Arthur J. Rhodes has been appointed City Engineer of Manhattan, Kan., succeeding Fred Walters who, as noted in a previous issue, was killed in an automobile accident. Mr. Rhodes was formerly Assistant City Engineer.

J. T. Ellison, Division Engineer of the Minnesota State Highway Commission, is to have supervision over state road construction in Otter Tail, Wilkin, Traverse, Grant, Stevens, Douglas, Big Stone, Chippewa, Pope and Swift counties, with headquarters at Fergus Falls, Minn.

A. N. Johnson, Consulting Highway Engineer of the Portland Cement Association, has recently been appointed to serve on a committee of the American Association of State Highway Officials, the duty of the committee being to collect from various state highway departments information as to changes which the states expect to make in their highway laws. Many states are at present planning revision or amendment of such laws so that they may take advantage of government id in road improvement.

Fred Bennett, for more than four years Highway Engineer of Bexar County, Texas, has resigned. Mr. Bennett makes this change to move to Denison, Texas, and become one of the members of the firm of Julian C. Feild & Co., consulting engineers. Mr. Bennett was associated with Julian C. Feild during 1910-11 in the building of the Denison road system, after which he went to San Antonio to become Highway Engineer of Bexar County. During his incumbency of that position he built the Bexar County highway system at a cost of slightly over $1,500,000, and since the completion of that work has inaugurated a maintenance system for the county roads.

PUBLICATIONS

"TESTS" ON CORRUGATED METAL CULVERTS." Bulletin of the Technology Experiment Station, University of Maine, Orono, Me. Paper, 6x9 in., 16 pp., illustrated.

The contents of this bulletin comprise detailed reports on experiments made on corrugated metal pipe samples sent to the Maine State Highway Department. In order to insure absence of bias or partiality on the part of those conducting the experiments each sample was given a number by the Highway Department, then it was sent to the University and the key to these numbers was retained at the Highway Department. The printed report contains this key.

ILLINOIS, VERMILION COUNTY. Report of the Superintending Engineer to the Road Improvement Committee of the Vermilion County Board of Supervisors. Paper 6x9 in., 38 pp. and covers; illustrated, inset table.

This report, dated at Danville, Ill., Jan. 1, 1917, comprises a detailed report on the work done in Vermilion County under the $1,500,000 bond issue approved in 1914. It includes in addition to the report proper, tabulations of bids, lists of contractors' outfits, a road map of Vermilion County, and reproductions of various forms used in the work. It is illustrated by a number of views showing work in progress, and contains a large inset table, showing details of bids received in March, 1916.

PUBLIC ROAD MILEAGE AND REVENUES IN THE UNITED STATES, 1914—A SUMMARY. Bulletin No. 390, U. S. Department of Agriculture; contribution from the Office of Public Roads and Rural Engineering, dated Jan. 12, 1917. Paper, 6x9 in., 12 pp. and covers.

This bulletin, as indicated by the title, is a summary of data secured by the Office of Public Roads and is based upon Bulletins 386, 387, 388 and 389. It shows, for each state, the total and surfaced mileage of public roads at the end of 1914, road and bridge revenues for 1914, the amount of state and local road and bridge bonds outstanding Jan. 1, 1915, and other information. Most of the information is contained in tabular statements arranged by states.

CONVICT LABOR FOR ROAD WORK. By J. E. Pennybacker, Chief, Division of Road Economics, and H. S. Fairbank, Highway Engineer, Office of Public Roads and Rural Engineering, and Dr. W. F. Draper, Passed Assistant Surgeon, U. S. Public Health Service. Bulletin No. 414, U. S. Department of Agriculture. Contribution from the Office of Public Roads and Rural Engineering. Paper 6x9 in. 218 pp. Illustrated, inset plans.

In this bulletin are included the results of an investigation conducted by the Office of Public Roads and Rural Engineering in cooperation with the United States Health Service during 1914 and 1915. These original investigations, it is stated in the introduction, were supplemented by correspondence and by the study of the literature of the subbject. The bulletin includes, besides a discussion of the matter of convict labor for road work, digests of convict road laws, recommendations by the authors and detailed instructions for carrying out these recommendations. The illustrations include half-tone reproductions of photographs of convict camps, plans of camp layouts and camp appliances and working drawings for the construction of camp building.

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Fourteenth Annual Convention of the American Road Builders' Association

In last week's issue was printed an account of the fourteenth annual convention of the American Road Builders' Association up to Thursday morning, Feb. 8. The proceedings of the remaining two days and other features of the congress are printed in the following paragraphs:

THURSDAY, FEB. 8.

Fifth Session

The fifth session of the convention was called to order at 10.00 a. m. by President Dean.

The subjects of the morning were "Stone Block Pavements" and "Wood Block Pavements." The latter subject was taken up first and was introduced by a paper entitled "Recent Practice in Wood Block Pavements," by Ellis R. Dutton, Assistant City Engineer of Minneapolis, Minn. In the absence of Mr. Dutton the paper was read by T. P. Clarke, Superintendent of Streets, Winchester, Mass. The discussion on the paper was opened by Geo. W. Tillson, Consulting Engineer of the Borough of Brooklyn, New York City, who was followed by Walter Beuhler of the Barrett Co., C. A. Kenyon of Washington, D. C., and others.

The subject "Stone Block Pavements" was introduced by Wm. H. Connell, Chief of the Bureau of Highways and Street Cleaning, Philadelphia, Pa., who read a paper entitled "Recent Practice in Granite Block Pavements." After reading the paper Mr. Connell exhibited a number of lantern slides showing the process of quarrying, manufacturing and laying granite block pavements, the views including scenes in the quarry and on the street. Other slides showed elaborate tabulations of annual costs of various kinds of pavements built by bond issue funds on streets of different classes.

The discussion on Mr. Connell's paper was opened by H. W. Durham of New York, formerly Chief Engineer of Highways of the Borough of Manhattan. Others who took part in the discussion were A. T. Rhoades, Street Commissioner of Worcester, Mass.; John Williams, of the Simpson Bros. Corporation, Boston; Wm. P. Hammersley, Superintendent of Streets of New Bedford, Mass.; H. R. Sprague, Assistant Engineer of Streets of Lowell, Mass., and C. D. Pollock, Consulting Engineer of the Granite Paving Block Manufacturers' Association.

Sixth Session

The sixth session was called to order promptly at two o'clock Thursday afternoon, President Dean occupying the chair.

In the absence of F. R. Williams, Paving Engineer of Cleveland, Ohio, the author of "Best Practice in Brick Pavement Construction," a paper introducing the subject of "Brick Pavements," the paper was read by J. Duchastel, City Engineer of Outremont, P. Q.

The discussion on Mr. Williams' paper was opened by G. R. Ramsey, of Orlando, Fla., with George Hogarth, Chief Engineer, Department of Public Works, Province of Ontario Canada, in the chair, in the place of President Dean. The discussion was continued by Mr. Duchastel, L. M. Hastings, City Engineer of Cambridge, Mass.; I. E. Johnson, Superintendent of Streets of Weymouth, Mass.; E. R. Kinsey, of the Board of Public Service, St. Louis, Mo.; John Hahn, of Boston, Mass.; R. Keith Compton, Chairman and Consulting Engineer of the Paving Commission of Baltimore, Md.; Geo. T. Donoghue, Chief Engineer of the Commissioners of Lincoln Park, Chicago, Ill.; Nelson P. Lewis, Chief Engineer of the Board of Estimate and Apportionment of New York City; Will P. Blair, Secretary, National Paving Brick Manufacturers' Association; O. F. Winslow, Street Commissioner of Nashua, N. H.; W. T. Blackburn, Consulting Engineer, Dunn Wire-Cut Lug Brick Co., Conneaut, Ohio, and others.

At the close of the discussion on Mr. Williams' paper, President Dean announced that the "Question Box," scheduled for the afternoon, would have to be postponed until Friday morning on account of the lack of time.

The report of the Committee on Credentials was then made by the chairman of the committee, R. A. Meeker, State Highway Engineer of New Jersey. The report, which was accepted as read, follows:

Report of the Committee on Credentials

Your Committee on Credentials respectfully reports that there are present official delegates representing twenty-three states of the Union, appointed by the governors of those states; also official representatives of three provinces of Canada.

In addition thereto there have been presented the credentials of official delegates representing one hundred and one cities located in twenty-seven states of the Union and two provinces of the Dominion of Canada.

A further interest is manifested in the convention by the appointment of official delegates from nine chambers of commerce located in various states throughout the United States.

Several municipalities and states not otherwise represented have appointed delegates. In this manner thirty-five states are represented in this convention.

Signed,
R. A. MEEKER (Chairman).
R. H. GILLESPIE
F. E. ELLIS.
R. KEITH COMPTON.
W. T. HEADLEY.

After the acceptance of the report of the Committee on Credentials, J. W. Hunter, First Deputy Commissioner of the Pennsylvania State Highway Department, Chairman of the Committee on Resolutions, presented the report of that committee. The report, which was adopted as read, follows:

Report of the Committee on Resolutions

RESOLVED: That this Association expresses its appreciation of the cordial welcome extended to it by His Excellency the Governor of the State of Massachusetts, His Honor the Mayor of Boston, and the Boston Chamber of Commerce.

RESOLVED: That this Association extends its sincere thanks to the state, county and city officials, the commercial organizations of the city, and especially to the Massachusetts Highway Association and to the Massachusetts State Automobile Association, for the many courtesies extended by it, all of which have contributed so conspicuously to the enjoyment and profit of those in attendance at this convention.

RESOLVED: That this Association hereby expresses its appreciation of the valuable cooperation of the manufacturers, states, cities, and all others who have, by their excellent exhibits and efforts, contributed to the value and instructiveness of this convention.

RESOLVED: That this Association recognizes the value of the work done both by the local and general press in disseminating information regarding this convention, and it hereby tenders its thanks for the same.

RESOLVED: That this Association expresses its appreciation and tenders its thanks to the local committees of finance, entertainment, accommodations, transportation and information for the very thorough and effective work performed before and during the progress of the convention, and especially to the committee on ladies' entertainment, for the instructive and interesting program provided.

And also that the Association particularly appreciates the courtesy of his Honor the Mayor in giving a theater party to the visiting ladies.

WHEREAS, the development of military operations in Europe during the past year has so fully demonstrated the absolute necessity of having a system of national highways connecting strategic points for military purposes; therefore,

BE IT RESOLVED: That the proper committee of Congress be notified that it is the sense of this meeting that steps be taken immediately for the construction of such a system of improved roads as will best serve the country in time of war, and which will form a part of the program of preparedness.

On a motion made by James H. MacDonald, former State Highway Commissioner of Connecticut, and a past president of the association, President Dean appointed Mr. MacDonald, Henry Welles Durham, and E. L. Powers, Secretary of the Association, a committee of three to frame and transmit to the members of the family of the late Harold Parker, a former president of the association, suitable memorial resolutions.

After the appointment of this committee, the business meeting of the American Road Builders' Association was called to order, the first business taken up being the report of the Committee on Revision of the Constitution. This report, which was presented by Past President Tillson, chairman of the committee, recommended certain minor changes in the by-laws. President Dean stated that the report had been approved by the Board of Directors and on a vote by the meeting it was accepted as read.

The Committee on Resolutions, through Chairman Hunter, then reported on a resolution referring to a certain regulation of the Department of Agriculture on the administration of federal aid road work which had been introduced by L. D. Smoot, Street Commissioner of Jacksonville, Fla., at a previous session. The committee recommended that this resolution be not adopted and after considerable discussion the committee's recommendation was adopted. [A full report of this discussion is printed on other pages of this issue.—Ed.]

The reports of Secretary E. L. Powers and Treasurer W. W. Crosby were read by the former and both were accepted.

R. A. Meeker moved the election of a nominating committee consisting of James H. MacDonald of Connecticut, Chairman; F. A. Reimer of New Jersey, J. W. F. Bennett of New York, W. A. McLean of Canada, Charles H. Moon of Pennsylvania, F. C. Pillsbury of Massachusetts and Frank B. Dunn of Ohio. The committee was elected.

President Dean announced the reception of invitations to hold the next convention in Mobile, Ala.; Hot Springs, Ark.; San Francisco, Cal.; Jacksonville, Orlando, Tallahassee, Fla.; Gulfport, Miss.; Toledo, O.; Philadelphia, Pa.; Chattanooga, Tenn.; Milwaukee, Wis., and Montreal, P. Q. An invitation was also received from Texas to hold the convention in some city in that state, preferably Dallas. On a motion made by Mr. Tillson, these invitations were referred to the executive committee in accordance with the custom of the organization.

The following telegram from Maj. W. W. Crosby, Treasurer of the association, who is absent on duty with the Army at the Mexican Border, was read by President Dean.

"Best wishes to all my friends and for the convention."

A motion was made and passed that the secretary send an appropriate telegraphic reply to Maj. Crosby, if he had not already done so.

FRIDAY, FEBRUARY 9.

Seventh Session

The seventh session, which was devoted to the subject "Contractors' Plant and Equipment," was called to order Friday forenoon by President Dean, who later turned over the chair to Past President Tillson. The subject of the morning was introduced by a paper entitled "The Excavation, Manipulation and Transportation of Materials," written and read by John H. Gordon, a contractor of Albany, N. Y.

The discussion on Mr. Gordon's paper was opened by F. E. Ellis, Manager of the Essex Trap Rock & Construction Co., of Melrose, Mass., who was followed by Richard Hopkins, Troy, N. Y.; Eugene Phelps, Pitchfork, Wyo.; C. H. Morrill, of the Massachusetts Highway Commission; I. J. Rockwood, Rochester, N. Y.; Walter Warren, Portland, Ore.; R. F. Hudson, Melrose, Mass.; H. C. Hill, Binghamton, N. Y.; O. F. Winslow; Raymond W. Coburn of the Massachusetts State Highway Commission; President Dean; James H. MacDonald, who took the chair during the discussion; H. A. Baker of Rockland, Mass., and others.

At the close of the discussion on Mr. Gordon's paper the "Question Box," which had been postponed from the previous session, was taken up. The first question announced was one as to the practicability of the concave section for roadways. It was discussed by F. E. Ellis; Sidney Smith of Boston, Mass., the author of the question; O. F. Winslow; H. A. Baker; J. Duchastel, and L. A. Grabill, Supt. of Suburban Roads, Washington, D. C.

The next question, which was asked by O. F. Winslow, was whether or not engineers in designing and preparing specifications give proper attention to the influence of the type of pavement selected upon the depth of foundation. The question was discussed by Mr. Winslow and Mr. MacDonald.

The third question taken up was whether or not the binder course in sheet asphalt pavement should be omitted, and if so why. The question was discussed by D. B. Goodsell, Assistant Engineer of the Department of Public Works, Borough of Manhattan, New York, N. Y.

The last question announced was one relating to the apportionment of the cost of a state road carrying through traffic within the limits of a town of small valuation. It was discussed by O. F. Winslow and E. S. Larned of Framingham, Mass.

Eighth Session

The eighth session was called to order at 2.00 p. m. on Friday by President Dean, who introduced, as presiding officer of the afternoon, F. E. Everett, State Highway Commissioner of New Hampshire. The paper of the afternoon session—"Traffic Census; Its Application to the Design of Roadways, Selection of Pavements and Traffic Regulation"—was read by its author, D. B. Goodsell.

The paper was followed by a number of lantern slides showing traffic conditions on city streets.

The discussion was opened by Geo. T. Donoghue, who was followed by Col. W. D. Sohier, Chairman of the Massachusetts Highway Commission, T. P. Clarke, and E. M. Vail, Division Engineer of the New Jersey Department of Public Roads.

After the close of the discussion on Mr. Goodsell's paper, there was a long general discussion principally on the subject of concrete roads in which part was taken by O. F. Winslow, L. R. Grabil, Col. Sohier, E. S. Larned, Jas. H. MacDonald and others.

The convention adjourned sine die at about 4.00 o'clock.

Reception and Ball.

On the evening of Thursday, Feb. 8, nearly 500 delegates and guests attended a formal reception and ball at the Hotel Copley-Plaza. There was a reception from eight until nine o'clock and dancing from eight until one. Lieut. Governor and Mrs. Coolidge, Mayor and Mrs. Curley, Col. and Mrs. Sohier and Mr. and Mrs. A. W. Dean received.

Entertainment

Besides the smoker and the annual dinner noticed in "Good Roads" for Feb. 10, and the reception and ball noted above, the entertainment features of the convention included a theater party for the ladies on Wednesday evening, visits to the various points of interest in and around Boston, and a series of teas for the ladies of the convention at various times during the week.

Lecture on the Columbia Highway

On the evening of Friday, the last day of the convention, a lecture on the Columbia Highway was given at Convention Hall by Samuel C. Lancaster, C. E., of Portland, Ore. The lecture was illustrated by motion pictures and by colored lantern slides.

Eighth National Good Roads Show

The Eighth National Good Roads Show, comprising an exhibition of machinery, materials and equipment for road and street work, was held during convention week at Mechanics Building, the show opening on Monday, the day before the convention, and closing Friday afternoon. As in previous years, it comprised a large and varied display of machinery and materials, occupying the main floor and the ground floor of a part of the building. The heavier machinery, such as motor trucks, concrete mixers, driers, oilers and similar equipment, was displayed on the lower floor, while the main floor was given up to the lighter displays of materials and methods of construction. This floor also accommodated the educational exhibits from states, cities and educational institutions. A list of the exhibitors follows:

Commercial

Acme Road Machinery Co.	Frankfort, N. Y.
Adams Co., J. D.	Indianapolis, Ind.
American Car Sprinkler Co.	Worcester, Mass.
"American City"	New York, N. Y.
American Tar Co.	Boston, Mass.
Amies Road Co.	Easton, Pa.
Asbestos Protected Metal Co.	Pittsburgh, Pa.
Aspha-Bric Corporation	New York, N. Y.
Atlantic Refining Co.	Philadelphia, Pa.
Autocar Company	Ardmore, Pa.
Baker, Jr., John	New York, N. Y.
Baker Motor Sales Co.	Cambridge, Mass.
Barber Asphalt Paving Co.	Philadelphia, Pa.
Barber Asphalt Paving Co. (Iroquois Works)	Buffalo, N. Y.
Barrett Company	New York, N. Y.
Bitoslag Paving Co.	New York, N. Y.
Bond Co., Harold L.	Boston, Mass.
Boston Trailer Co.	Boston, Mass.
Bucyrus Company	South Milwaukee, Wis.
Buffalo Springfield Roller Co.	Springfield, O.
Carey Co., Philip	Lockland, Cincinnati, O.
Cast Iron Pipe Publicity Bureau	New York, N. Y.
Clinton Power Pump Co.	Clinton, Mass.
Clinton Wire Cloth Co.	Boston, Mass.
Concrete Steel Co.	New York, N. Y.
Cummer & Son Co., F. D.	Cleveland, O.
Denmo Company of Boston	Boston, Mass.
Dunn Wire-Cut Lug Brick Co.	Conneaut, O.
Duplex Truck Company	Lansing, Mich.
Dyar Supply Co.	Cambridge, Mass.
Earnshaw, H. P. J.	Boston, Mass.
East Iron & Machine Co.	Lima, O.
Edson Mfg. Co.	Boston, Mass.
"Engineering News"	New York, N. Y.
"Engineering Record"	New York, N. Y.
Franklin Contracting Co.	New York, N. Y.
Garford Motor Truck Co.	Lima, O.
General Equipment Co.	New York, N. Y.
General Motors Truck Co.	Pontiac, Mich.
"Good Roads"	New York, N. Y.
Good Roads Machinery Co.	Kennett Square, Pa.
Granite Paving Block Mfrs.' Assn.	Boston, Mass.
Gurley, W. & L. E.	Troy, N. Y.
Haiss Mfg. Co., George	New York, N. Y.
Hastings Pavement Co.	New York, N. Y.
Headley Good Roads Co.	Philadelphia, Pa.
Heil Company	Milwaukee, Wis.
Hetherington & Berner	Indianapolis, Ind.
Houdlette & Son, Inc., Fred A.	Boston, Mass.
Hvass & Co., Chas.	New York, N. Y.
Independent Coal Tar Co.	Boston, Mass.
International Harvester Company of America	Chicago, Ill.
International Motor Co.	New York, N. Y.
Jaeger Machine Co.	Columbus, O.
Jennison-Wright Co.	Toledo, O.
Judd, John L.	Boston, Mass.
Keystone Driller Co.	Beaver Falls, Pa.
Kinney Mfg. Co.	Boston, Mass.
Koehring Machine Co.	Milwaukee, Wis.
Lansing Company	Lansing, Mich.
Lebanon Machine Co.	Lebanon, N. H.
Lenox Motor Car Co.	Boston, Mass.
Locomobile Company of America	Boston, Mass.
Mack Motor Truck Co.	Cambridge, Mass.
"Manufacturers' Record"	Baltimore, Md.
Maxfer Truck & Tractor Co.	Boston, Mass.
McKim Co., Inc., R. B.	Boston, Mass.
Metropolitan Paving Co.	Cleveland, O.
"Municipal Journal"	New York, N. Y.
National Paving Brick Mfrs. Ass'n	Cleveland, O.
New England Road Machinery Co.	Boston, Mass.
New England Truck Co.	Fitchburg, Mass.
Oakland Motor Co. of N. E.	Boston, Mass.
Orenstein-Arthur Koppel Co.	Koppel, Pa.
Packard Motor Car Co.	Boston, Mass.
Portland Cement Association	New York, N. Y.
Portland Stone Ware Co.	Boston, Mass.
Puritan Iron Works	Boston, Mass.
Reade Manufacturing Co.	Hoboken, N. J.
Robeson Process Co.	New York, N. Y.
Rockwell, Inc., C. P.	Boston, Mass.
Schramm & Son, Chris. D.	Philadelphia, Pa.
Signal Motor Truck Co. of N. E.	Boston, Mass.
Standard Oil Company (Indiana)	Chicago, Ill.
Standard Oil Company of New York	New York, N. Y.
Stegeman "Six" Truck Co. of N. E.	Boston, Mass.
Sterling Motor Truck Co.	West Allis, Wis.
Thew Automatic Shovel Co.	Lorain, O.
Turbine Sewer Machine Renovating Co.	Milwaukee, Wis.
United Gas Improvement Co.	Philadelphia, Pa.
United States Asphalt Refining Co.	New York, N. Y.
United States Cast Iron Pipe & Foundry Co.	Burlington, N. J.
Warren Brothers Company	Boston, Mass.
Weston, L. A.	Adams, Mass.
White Company	Boston, Mass.
Wiard Plow Co.	Batavia, N. Y.
Willite Road Construction Co. of America	New York, N. Y.
Wyoming Shovel Works	Wyoming, Pa.

Non-Commercial

United States Government.
City of Boston.
Florida State Road Department.
Maine State Highway Commission.
Massachusetts Highway Commission.
Massachusetts Institute of Technology.
New Hampshire State Highway Department.
New Jersey Department of Public Roads.

Papers Presented at the Fourteenth Annual Convention of the American Road Builders' Association—II.

Note: Three of the papers presented at the Convention were printed in GOOD ROADS for Feb. 10; others will appear in a later issue.

Bituminous Roads and Pavements and Treatments

By W. R. FARRINGTON,

Division Engineer, Massachusetts Highway Commission

A consideration of bituminous road and street work divides naturally under two general heads—construction and maintenance.

CONSTRUCTION

Under Construction we will consider bituminous concrete, bituminous macadam and bituminous surface treatments.

Bituminous Concrete

Any discussion of bituminous concrete would, of course, be incomplete without some mention of sheet asphalt. It probably is not advisable, however, to devote much time to this, partly because of lack of personal experience in its construction and also because it is assumed that the details of construction are familiar, since this pavement has been in common use in the larger cities for at least 20 or 25 years.

It is also probable that surfaces and pavements in general use on roads outside the large centers will be of most interest. In passing, the writer would state only that sheet asphalt on a concrete base has given excellent service in many localities for many years, and also that with the possible exception of the larger departments where suitable equipment and experienced workmen are available the work should be done by contract and a guarantee, preferably for 10 years, should be required.

Topeka Specification and Similar Pavements

Surfaces or pavements constructed under the "Topeka specifications" and similar pavements are apparently increasing in favor for roads and streets carrying heavy travel, and where for various reasons it is not considered advisable to use sheet asphalt or to pay the royalty on patented pavements.

These pavements differ from sheet asphalt largely in the size and grading of the aggregate and to some extent in the hardness of the asphalt or oil asphalt used. In some localities, tar is being used in place of asphalt or oil asphalt, the advocates of tar claiming for it less cost for the material and also greater ease and hence less cost of mixing. Broken stone to the ¾-in. size is used with some of these pavements and with others even larger stone. These pavements can be constructed at a reasonable cost and are giving good service. Successful results depend not alone on the use of suitable bituminous materials and good workmanship, but also to a large extent on careful selection and proper grading of the aggregate. With the sand available in many localities, the addition of either cement or stone dust, or both, is necessary to insure good results.

Broken Stone and Bituminous Surfaces or Pavements

Broken stone and various bituminous materials are being used quite extensively with good results on the heavier traveled roads outside the cities. The usual form of construction is a base of broken stone from 3 to 5 in. thick, after rolling, the voids in this course being filled with stone dust, screenings or sand. The top or wearing course, which should be from 2 to 3 in. thick, after rolling, consists of broken stone mixed with the bituminous material, in a suitable mixer, before placing. In some cases, the stone as well as the bituminous material must be heated to insure good results.

The lake asphalts, oil or residuum asphalts and tar are used for this work. Just enough bituminous material to thoroughly coat the stone should be used. Less bituminous material means possible disintegration due to lack of bond, and too much is likely to result in too heavy a coating and eventual rolling of the surface.

Formerly it was customary to use only stone to the 1¼-in. or 1½-in. size in the wearing course, but at present larger stone is being used for heavy travel. In this connection it is probably of interest to note that the change in travel has resulted in a general tendency to turn the road upside down. Formerly the larger stone was placed in the lower course and the smaller stone on top; at present the small stone is put in the lower course (to get rid of it) and the larger stone on top, either alone or with just enough small stone to fill the voids.

The same advantages are claimed for tar in this work as mentioned under "Topeka specification" pavement, while the advantage claimed for the asphalts is less cost of maintenance. Under similar travel and conditions, the tar road will require more frequent sealing than the asphalt road, but it is only fair to state that the cost of resealing is small. The advocates of asphalt also claim that even with a seal coat, the tar will lose its life sooner than asphalt and consequently that the asphalt surface or pavement is a more permanent one.

While a seal coat is not necessary with mixed work when constructed, it is in some cases a matter of economy. This is especially true with tar. For sealing a tar road, either tar of about the same grade as used in mixing or a much lighter grade can be used. Asphalt or heavy oil asphalt can also be used but with these materials the best results are probably obtained by delaying the application for at least several weeks after construction. About ½ gal. of bituminous material should be used per square yard for sealing.

Sand and Asphalt or Oil Roads

This brings us to a consideration of sand and oil roads, and as it is probable that this construction is not familiar to all, the details of the work will be described as far as the limits of this paper will allow.

The first oil and dirt roads were constructed in the West—presumably in California. It is probable, however, that sand and oil roads were first constructed in this state, the first layer road in 1905 and the first mixed road in 1908.

While these roads have attracted considerable attention, especially in the South where sandy soils prevail, there is evidently more or less misunderstanding about them. Apparently some parties have assumed that these surfaces would prove a panacea for all road troubles, while others have considered that the sand and oil work was an endeavor—and not a very successful one—to imitate or approximate sheet asphalt, "Topeka specification" or similar pavements. Neither view is correct. The Highway Commission in this state has, we believe, developed a surface which is suitable for the travel and conditions in those sections where it is being constructed and the cost of which is not greater than the conditions will warrant. These surfaces have not only enabled the Highway Commission to improve the main roads on Cape Cod and vicinity much sooner and at a much less cost than would otherwise have been possible, but have also solved satisfactorily the road problem on many town highways. On the other hand, these surfaces, constructed with the sand usually available and without the addition of other aggregate, will not carry a large amount of heavy travel, especially if the proportion of horse-drawn vehicles is large.

Experiments are being made, however, including the addition of cement and stone dust, and the results apparently warrant the belief that some combination will be found eventually, which will result in a surface that will carry heavy travel economically. The present idea is a base of the ordinary mixture and a wearing surface of the stronger mixture. Such a surface will not be a cheap one, but it is expected that the cost will be considerably less than that of sheet asphalt and similar pavements.

It would, of course, be possible to approximate these pavements, but the cost would be prohibitive on country roads.

In the discussion of sand and oil work, several points are apparently often overlooked. One is that the sand and oil mixture serves not only for a wearing surface but also as the base. It is true that the subgrade, if soft, is hardened, but only sufficiently to keep it from being cut up during the construction of the surface. Sandy loam or clay is ordinarily used for hardening, and these materials do not add materially to the strength of the surface.

Another point is that, as at present constructed, these surfaces are intended only for roads where there is not a large amount of heavy traffic and where the conditions will not warrant an expensive surface. In fact, these surfaces were designed originally to take the place of water bound macadam with a bituminous blanket.

The third point is that these roads are always sealed and this sealing gives a surface containing a much larger percentage of bituminous material and prevents the disintegration of the mixture, which would otherwise probably result.

As to the details of construction, some mention should first be made of equipment. Portable asphalt plants have been used to some extent, but it is the general opinion that the cost of such outfits and the cost of transportation are excessive for work of this kind. The usual outfit consists of a mixer similar to a concrete mixer (ordinarily a cube) with charging device and in most cases equipped with a hot attachment—and a mechanical drier. These driers are similar to the drums used with asphalt plants but the flame, instead of being thrown between the drum and a jacket, as is customary with asphalt plants, is thrown either directly into the end of the drum (which is not jacketed) or into a combustion chamber at one end of the drum. Pipe or arch heaters are still used for heating or drying the sand but are being replaced rapidly with the driers described above.

The asphalt or oil asphalt is heated in kettles before mixing. Where the ordinary hot attachment is used the oil is poured into the mixer through the flame. This fact has led some to believe that the bituminous material must be burned and that the roads will inevitably fail for this reason. However, roads in use between four and five years do not show signs of deteriorating as yet. The reason the bituminous material is not burned is probably lack of sufficient oxygen in the mixer to cause combustion.

The sand and oil mixture is carted to the road and spread usually in one course. The mixture is shaped with rakes and immediately rolled. A horse-roller is used for the preliminary rolling, but the surface should be rolled with a tandem steam roller in the course of a few hours. Before rolling with the steam roller, and, if necessary, during this rolling, the surface is reshaped with a road machine which removes any inequalities developing during the preliminary rolling. This reshaping is necessary as it is impossible to roll the mixture while hot without forcing it somewhat out of shape. Rolling with a steam roller is also necessary to thoroughly compact the surface. Without this rolling the surface will be porous enough to absorb moisture with the resultant frost action which means eventual disintegration. A steam roller, however, cannot be used until the mixture has partially set, and it is for this reason that the horse roller is first used.

Asphaltic oils of various grades and oil asphalts having a penetration of from 60 to 150 (Dow Penetrometer) have been used, but ordinarily the best results have been obtained with oil asphalts having a penetration of from 90 to 125.

If the grains of sand are rounded and especially if the size of the grains varies little, as with ordinary beach sand, a very heavy oil asphalt gives the best results.

As to the aggregate, a sharp, well graded sand with some fairly coarse particles is most satisfactory.

Relative to proportions, from 15 to 25 gal. of oil have been used per cubic yard of loose sand, but ordinarily the best results have been obtained by the use of about 16 gal. per cubic yard of sand, loose, or about 18 gal., compacted. With this, as with other mixed work, just enough bituminous material should be used to thoroughly coat the aggregate, hence, the finer the aggregate the larger the amount of bituminous material needed. A mixed sand and oil surface should be not less than 16 ft. wide, and 18 ft. is preferable for ordinary travel. The depth should be not less than 4 in. in the center and 3½ to 4 in. on the sides.

Before the completion of the work a seal coat should be applied, using about ½ gal. of fairly heavy hot oil per square yard, with sufficient sand to take up the oil. Two ¼-gal. applications of oil are preferable to one ½-gal. application.

Bituminous Gravel

Gravel and oil, or bituminous gravel, is in some respects even more promising than sand and oil and as now constructed will apparently carry quite heavy travel economically.

The methods followed in constructing bituminous gravel surfaces are similar to those described for sand and oil, except that a larger proportion of bituminous material is used —ordinarily from 20 to 22 gal. per cu. yd. All of the rolling is done with a steam roller, preferably a tandem roller, and it is not necessary to shape with a road machine or to apply a seal coat. Also, the hot attachment is ordinarily not used in mixing. With these surfaces a base of gravel or broken stone is used and the mixed wearing course is from 2 to 3 in. in depth, after rolling. Where broken stone is used in the base, it is customary to use the stone dust and pea stone with the gravel for the bituminous top.

Either mixed sand and oil or bituminous gravel can be used to good advantage for resurfacing old water bound macadam or gravel surfaces.

Bituminous Macadam

Under Bituminous Macadam we will consider broken stone penetration work, and also, in this connection, sand and oil layer roads.

Broken Stone Penetration Work

In this state, in the use of broken stone and bituminous materials, we have to a large extent substituted the penetration for the mixing method. While it is realized that there are certain advantages in the mixing method, we believe there are also some very good arguments in favor of the penetration work.

In the first place, the cost is less even though to obtain good results it is necessary to use rather more bituminous material. Also it is believed that there is less chance of failure if the workmen are not expert. In addition, the cost of a suitable mixing outfit is considerable and the bituminous material for mixing usually has to be shipped in barrels, and so costs quite a little more than for penetration work, where it can be transported over the roads from a central station in the distributor carts or trucks, and can be shipped in tank cars provided suitable heating apparatus is available.

With penetration work, the voids in the first course of stone—which is usually 3 or 4 in. thick after rolling—are filled with stone dust or sand. The wearing course of stone, from 2 to 3 in. thick, is spread, rolled and grouted with the bituminous material, from 1½ to 2 gals. per sq. yd. being used for this part of the work. The surface is covered lightly with pea stone or sand, preferably the former, and thoroughly rolled. Before the completion of the work the surface is cleaned by sweeping and a seal coat applied. For this about ½ gal. of the bituminous material is used, and covered with pea stone or sand.

With asphalt or oil asphalt, material of about the same penetration as for grouting is generally advisable, although in some cases where the seal coat has not bonded thoroughly, a 1/6-gal. application of heavy cold oil has stopped the tendency to break away from the surface.

With tar, a much lighter grade is often used for the seal coat.

To obtain good results in penetration work, it is necessary that the stone be clean and the surface dry.

There must also be sufficient voids to allow the bituminous material to penetrate at least 2 in. below the surface, and this means that a stone soft enough to crush under the roller will not give good results, even if strong enough to carry the travel to which the road is subjected.

At present, while in some cases stone to the 1¼-in. or 1½-in. size is used, it is customary to use for the wearing course stone from 1¼ to 2¼ in. either alone or with just enough smaller stone to fill the voids.

The so-called double penetration method has also been used to some extent in this state. Under this method the wearing course is formed by successive layers of stone with an application of bituminous material between each two courses, and with a seal coat. The advantage of this method is that less bituminous material is required and the principal disadvantage is the necessity of using small stone for the wearing course.

Another method of penetration is to mix sand with the bituminous material before it is applied. This method gives good results but the cost is greater and the surface is usually not quite as even as with ordinary penetration work.

The reason for the greater cost is the necessity of shipping the bituminous material in barrels, heating both the bituminous material and sand and then mixing by hand in a tank. Also after the mixture is run on to the road by means of a chute it has to be broomed into the stone. The usual proportions are about 40% sand and 60% bituminous material. A coarse sand cannot be used as it will not remain suspended in the bituminous material, and with any sand it is necessary to agitate the mixture constantly, until it is run on to the road. Both tar and asphalt, with a penetration of about 125, have been used for this work.

While, as stated, the first cost of such a surface is greater than of one constructed by the ordinary penetration method, the results so far indicate that the surface will last longer, that resealing is not necessary as often, and that the cost of maintenance will be less.

This method is not practicable except where proper sand is available, and much of the sand which gives excellent results for ordinary penetration cannot be used by this method.

Sand and Oil Layer Work

In connection with penetration work, some mention of sand and oil layer roads would seem pertinent.

The first sand and oil roads in this state were constructed by this method, which might also be called the double penetration method.

When the work was started the California method of constructing dirt and oil roads was tried. This method consists of shaping the road surface, applying the oil, and working it into the road by harrowing and by the use of a tamping roller. It was soon found, however, that this method was not successful with sand, and the layer method was evolved. In constructing a road by this method, the subgrade is shaped and any sandy places hardened sufficiently to keep the teams used in construction from cutting up the subgrade. For hardening, sandy loam or clay is ordinarily used. One and one-half gal. of a fairly heavy hot oil, similar to that used for hot blankets, is put on per square yard in two applications, or 2 gal. in three applications. Sand is spread after each application and the surface rolled with a horse roller. The 1½-gal. treatment should give eventually a thickness of about 3½ in. and the 2-gal. treatment about 4 in.

If only 1½ gal. are used, it will probably be necessary to apply about ½ gal. the following season. On the whole, this method is preferable, as any surface constructed of sand and oil by the layer method will be more or less out of shape for some time after the oil is applied, and weak places will develop. By delaying the final application of oil until the following season, the weak places can in the meantime be strengthened and the surface evened up by scraping with a road machine.

The layer road will carry only light traffic and is a suitable type of road only where the conditions will not warrant a more expensive surface. On the other hand, where sand is available and the traffic light, such a road can not only be constructed at a comparatively small cost, but can be economically maintained.

Bituminous Surface Treatment

To some it may seem that bituminous surface treatment, except as auxiliary to mixed or penetration work, etc., is or ought to be largely a thing of the past. It is a fact, however, that in certain localities the travel and financial conditions will not warrant even as expensive construction as mixed bituminous or penetration surfaces. For such conditions, water bound macadam or gravel surfaces with an oil or tar blanket are suitable.

While bituminous surface treatment for such roads has been thoroughly discussed during the past few years it seems well to give this work some attention.

The hot oil blankets formed by the use of oils with a high viscosity, have given good results in some cases and are most economical, provided the surface bonds thoroughly with the road metal and does not roll or bunch. However, the tendency to peel from the road, or to roll or bunch, and the difficulty of repairing if this does happen, has resulted generally in the substitution of the heavier grades of the so-called "cold oils," some of which, incidentally, have to be heated slightly to apply satisfactorily. The same is true of tar, for while tar does not bunch as badly as oil the heavy tar does not bond readily with the surface.

The details of bituminous surface treatment will be gone into more fully under "Maintenance."

MAINTENANCE

Bituminous Concrete

Maintenance of Sheet Asphalt and Similar Pavements

As to the maintenance of sheet asphalt and similar pavements, the writer would only state that to properly patch such pavements, the old material must be cut out to the base or for a depth of at least 2 in., and the sides of the hole be left fairly straight. The hole should be filled with mixed material similar to that used in construction and this material should be thoroughly tamped or rolled. An asphalt smoothing iron can also be used to good advantage.

Maintenance of Mixed Broken Stone and Bituminous Materials

A surface constructed of broken stone and bituminous material by the mixing method should probably have a seal coat applied after some years, as the road metal becomes exposed and resealing will be necessary sooner and oftener with tar than with asphalt, as the latter tends to work up slowly and reseal the surface.

Other ordinary maintenance consists in filling depressions. For slight depressions, pea stone can be used, but for deeper depressions, larger stone is advisable. The materials should be mixed before placing.

Maintenance of Mixed Sand and Oil Roads

Mixed sand and oil surfaces should be resealed occasionally; usually once in from three to five years, depending on the amount of travel. For resealing, either a heavy hot oil or the heaviest so-called cold oil, can be used, from ¼ to ½ gal. per sq. yd. being required.

If the surface becomes uneven, it can be improved by scraping with a heavy road machine, preferably one drawn by a steam roller.

Depressions in the surface should be filled with bituminous material and sand or pea stone mixed before placing.

In resurfacing sand and oil roads at least 2 in. of new mixture should be applied, and if the old surface is much out of shape it should first be evened up as any considerable inequalities will be reproduced eventually in the finished surface.

Maintenance of Bituminous Gravel Surfaces

The methods of maintaining bituminous gravel surfaces are similar to those for sand and oil surfaces except that gravel should be used in place of sand.

Bituminous Macadam

Maintenance of Broken Stone Penetration Surfaces

The maintenance of broken stone penetration surfaces is similar to the work on mixed surfaces except that in filling depressions the materials can either be mixed before placing or the stone can be put in the depression and grouted. The latter method costs a little less and is satisfactory if the work is carefully done, but mixing is, on the whole, advisable.

Penetration surfaces usually require resealing oftener than mixed surfaces, but ordinarily not over ¼ gal. per sq. yd. of bituminous material is required, so the cost is small. On tar penetration surfaces, either a heavy or light tar, or asphalt, can be used (although it is not advisable to use the latter for at least a year after construction).

With asphalt or oil asphalt surfaces, bituminous material similar to that used for construction is ordinarily used, but in some cases a light application of heavy cold oil has given good results.

Maintenance of Sand and Oil Layer Roads

Ordinary repairs on sand and oil layer roads consist of reshaping from time to time with a heavy road machine, filling depressions with sand and oil or pea stone, and applying additional oil as needed.

Bituminous Surface Treatment

In the maintenance of water bound macadam and gravel roads, bituminous surface treatments have for a number of years played, and without doubt will continue in the future to play, an important part.

The use of oil and tar blankets has caused some inconvenience and resulted in considerable criticism, especially with the lighter grades, because of tracking into the houses, the splashing of vehicles and occupants, and the muddy and slippery condition when wet. The heavier grades have also come in for some criticism, principally because of the tendency to bunch and form uneven surfaces.

In considering these treatments, we sometimes forget the important part they played during the transition period, with the first rapid increase of motor vehicles and before the necessary funds were available for reconstruction or other permanent treatment. In fact, it is difficult, notwithstanding the many object lessons, to realize just what the condition of the roads would have been generally if these materials had not been available at that time. Also, today the cost of maintenance of many miles of town highway and county road would, without the use of these materials, be beyond the ability of many towns to meet.

It is, of course, a fact that on heavily traveled routes water bound macadam and gravel surfaces are not economical, but they will, without doubt, continue to be used in many localities, and are satisfactory for light travel. Consequently, bituminous surface treatments are of considerable importance.

In this state we have, as stated under "Construction," abandoned generally the use of the heavy for the lighter grades of both oils and tars for surface treatment.

With the old macadam surfaces, thoroughly bonded by travel, before the advent of the automobile, the heavy oil or tar treatment was economical and satisfactory for some years. In fact, some of these surfaces remained in good condition with but slight repairs for four or five years, but all became uneven eventually. Many of these roads have been reconstructed, but some have been maintained by removing the worst bunches by hand or with a road machine and eventually applying a light coat of cold oil.

In removing bunches a road machine can be used to good advantage when—and only when—the conditions are favorable. A combination of heat and moisture is necessary. This work is usually done during the warm weather in the summer, immediately after a rain or during a period of heavy mist or dew.

In removing bunches by hand, a cutting iron with a sharp edge but heavy enough to stand heating is useful. Square shovels can be used but last only a short time if heated repeatedly.

The material to be removed can be softened by building a small fire of twigs, etc., over the bunch. The same results can be obtained by pouring kerosene over the bunch and burning, but, unfortunately, no one has as yet discovered any practicable means of confining the burning action to the bunch, and the result is that the material for some distance around the bunch is also burned and rendered useless.

At present it is the general practice in this state to use for the first treatment about ½ gal. of oil with a viscosity of between 40 and 50 sec., Lawrence viscosimeter, at 100°C. [In this connection it is probably well to state that 100 sec. with the Lawrence viscosimeter at 100°C. equals approximately 173 sec. with the 100-cc. Engler viscosimeter at the same temperature, consequently 50 sec. with the Lawrence viscosimeter would be about the same as 86 sec. with the Engler viscosimeter.]

The second season about ⅜ gal. of oil with a viscosity of about 100 sec. should be applied and the third season from 1/6 to 1/4 gal. of similar oil. After that not over 1/6 gal. should be needed, and retreatment will probably not be necessary every year. After the second or third year, oil with a viscosity up to 200 sec. can be used to good advantage.

A combination of light and heavy oil has also been tried, the method being to form, with light oil, a thin coating thoroughly bonded to the road metal and then to apply about ¼ gal. per sq. yd. of hot oil with a viscosity of about 600 sec. It is hoped that this combination will have some of the advantages of the heavy oil blanket, without the tendency to roll and bunch.

The methods of applying and maintaining tar blankets are similar to those for oil, but tar does not take up as much sand or other grit as oil and hence does not form as thick a blanket. Tar does not tend to bunch as readly as oil but requires more frequent and heavier retreatment.

For such work cold tar with a viscosity of about 25 sec. is being used. A ½-gal. treatment is usually necessary the first two years, and after that a ¼-gal. treatment yearly.

Any water bound macadam or gravel surface maintained with oil or tar will have to be reconstructed or reshaped occasionally. With macadam, if not to be reconstructed, the usual custom is to break up the surface, remove the tar or oil if necessary and reshape. The roller picks, or a scarifier, or both, are used for breaking up, followed by a thorough harrowing, preferably using both the straight tooth and curved spring-tooth harrows. The former completes the breaking up and the latter brings the coarser particles of road metal to the top.

Usually some new stone is added and it may be necessary to use some sand or other material, as the voids must be filled to near the surface; but ordinarily there will be sufficient fine material in the old stone. To obtain good results there must be no sand or other fine material on the surface and the stone on top must be clean, but the voids must be filled so the bituminous material will not penetrate far below the surface. This is necessary, not only to avoid the use of an excessive amount of bituminous material and hence increase the cost, but also because with the grade used any surplus bituminous material in the voids will eventually work up and cause the surface to roll.

About ½ gal. of oil per sq. yd. should be put on in two applications with a covering of sand or other grit after each application.

Either light oil with a viscosity of from 100 to 200 sec. or a heavy oil with a viscosity of from 600 to 800 sec. can be used. If tar is used a larger quantity is necessary.

Before applying the bituminous material the road should be rolled with a steam roller. And much of the success of this work depends on a thorough rolling. A final rolling after the bituminous material has been applied and covered is advisable.

The best results are obtained by delaying the second application of oil or tar until at least a week after the first application, keeping the surface thoroughly covered in the meantime to prevent raveling; but in many cases, because of the conditions, the second application must be made soon after the first. In this case, care must be used not to apply too much covering after the first application, as it is, of course, difficult to remove any of this covering while the oil or tar is fresh without taking more or less of the bituminous material with it.

The methods used in forming oil or tar blankets on gravel and the methods of maintenance are similar to those for broken stone, except that for the first application it is essential that the oil or tar used be light enough to penetrate somewhat and thus form a thorough bond with the gravel.

In reshaping gravel it is necessary to loosen the surface only enough to shape with a road machine unless there is a thick blanket of oil or tar, in which case this must be removed or thoroughly broken up and mixed with the gravel by harrowing.

Policy and Program of Government in Road Construction Under the New Federal Aid Law

By LOGAN WALLER PAGE,
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Within less than twenty-five years road construction, maintenance, and management have been revolutionized. Two of the principal causes of this great change are, first, the advent and phenomenal extension of the motor vehicle, and, second, the concentration of population in cities. In its amazing development traffic has overflowed township, county, and state lines, and has extended such great distances from its point of origin as to complicate very greatly the question of adjusting tax burdens so as to establish an equitable relationship between the tax burdens and traffic. The concentration of population in the cities has rendered of vital importance the transportation of food products to the city and of manufactured products from the city to the country. This direct interest of the cities in the country highways has further complicated the problem of taxation, as manifestly the city should help to pay for that which is vital to its existence. State governments have, in most of the states, endeavored to meet these new conditions through the adoption of the policy of state participation and state aid. The passage of the Federal Aid Road Act has served to bring the federal government to the aid of the states through the working out of a great cooperative policy under which the states and the federal government share the expense of road construction under the terms of the act, and under which there is an apportionment of duties and responsibilities which makes the undertaking cooperative in the fullest sense.

The various provisions of the act develop a working plan thoroughly in harmony with this principle and take into account that portion of the undertaking which can best be accomplished by the states and that which can best be accomplished by the federal government. With the states rests the power of initiative and of determining whether or not they will participate in the benefits of the act. If they elect to participate, they have the power of making original selection of the roads for construction. They make the surveys, and prepare plans, specifications and estimates, and when the actual work of construction is reached, the duty of directly supervising the work, and of maintaining the roads constructed, is allotted to the state, while to the federal government falls the duty of inspection and approval, to the end that there may be a check and balance provided, and to the further end that the federal government may be assured that the money it appropriates is expended for the purpose intended.

The requirement in the federal aid road act that the proportion of cost paid by the federal government shall in no case exceed 50% is a provision which should encourage self-help and discourage the establishment of an insidious paternalism; it should strengthen the spirit of cooperation, as the mutual interest in the undertaking on the part of the federal government and the states is thereby emphasized; it should automatically check what might otherwise become an insistent and excessive demand upon the federal treasury, because the amount which the states will seek must be limited to the amount which they themselves are in a position to provide.

A very important provision in the act is that relating to assent by the states, and in the interpretation of this provision the fact must not be overlooked that the federal act covers a five-year period. Assent, therefore, involves at least a moral pledge on the part of the state to meet all the terms of the federal act, and to provide adequate funds or materials to meet the federal appropriation throughout the entire five-year period. It involves further a conception on the part of the state that it is undertaking an enterprise to be considered as a whole and not as a series of sporadic activities.

Questions innumerable, most of them of a hypothetical character, have been submitted to the Department of Agriculture. Many of these questions involve an interpretation of the Federal Aid Road Act. Other questions relate to the policy or program to be followed in the administration of the act and still other questions relate to matters wholly of procedure. It is opportune to state that, as a general proposition, I consider the rendering of definite opinions or decisions on purely hypothetical questions to be a mistake. We are endeavoring to meet the actual conditions as they arise. As examples of the questions which are coming up, I might state that there are many interpretations of the term "substantial construction," as used in the act. You will recall that in Section 6 there is a proviso that the Secretary of Agriculture shall approve only such projects as may be substantial in character. We have been asked to announce the classes or types of construction that might be defined as substantial and as to whether grading an earth road would be substantial construction. When it is considered that there are 48 states, with every conceivable kind of topography, climate, traffic, and other governing conditions, the impossibility of making any hard and fast determination on this point must be apparent. It is our intention to let each state submit its case and convince us, if possible, that the construction which it proposes is substantial in character.

We have been asked whether it is the policy of the department to confine the expenditure of the federal funds to transcontinental highways, to interstate highways, to trunk lines, to intercounty-seat highways, to main market roads, or to rural delivery routes. We can only answer this by calling attention to the fact that the original selection of the roads for construction rests, under the terms of the act, with the state highway departments except that the aid is restricted to rural post roads, and excepting further that the department expects each state to have some practicable scheme or program of improvement. As to just what constitutes a rural post road there are several contentions. As you know, the specific language in the act is that the term "rural post road" shall be construed to mean "any public road over which the United States mails are now or may hereafter be transported," excluding certain streets and roads in municipalities. The Attorney General of the United States has been requested to render an opinion which will clarify this definition and establish a definite basis for the determination as to each project that may be submitted. It is my personal opinion that those rural roads which serve the greatest population and carry the largest amount of produce should be first considered. Expressed in another way, they should be the highways which will best serve the traffic needs and develop the resources of the state.

With most of the state legislatures now in session, an immense amount of discussion is going on as to what a state needs to do in the way of legislation to enable it effectively to cooperate with the federal government. Some advocates of local control seem to feel that the highway department should be merely a channel through which the counties and townships may deal with the federal government. A careful reading of the federal act can hardly fail to correct such a misapprehension, for clearly the highway department must be the responsible agent of the state in the cooperative work done under the act. It must be technically qualified to submit suitable plans, specifications, and estimates of cost to the federal government. It must directly supervise all construction that is done under the terms of the act, not merely exercise a general and vague supervision, but a direct and responsible supervision. It must have the power to designate the payee who is to receive federal funds. In short, effective cooperation with the federal government cannot be conducted unless a state has a substantial highway department endowed with comprehensive duties and responsibilities.

We have been asked whether or not it is necessary for the state's proportion of cost of federal aid roads to be paid out of state funds. This is not essential, but it would greatly simplify the operation of the act if the state could provide the funds and leave county and township money to be applied to other roads. We have been asked also whether the direct supervision required by the act to be exercised by the state highway department will involve the award of contracts by the state instead of by the county. Nothing in the Federal Aid Road Act requires that the contract shall be awarded by any particular unit of government, but it is hardly conceivable that the state highway department can do all of the things required by the act, if at the same time county or townships may independently of the state highway department award contracts. It would seem to me as a working proposition that there must be at least an approval by the state highway department of any award of contracts by other officials.

A very important and to my mind a very necessary duty of the state highway department, if the fullest measure of benefit is to be reaped from the federal act, is that of carrying out any program of construction which may be submitted to the Secretary of Agriculture and approved by him. Many of the states leave entirely to the local units the initiative in selecting the roads on which state aid is to be applied and in applying for such aid. It seems to me that this must of necessity result in a lot of piecemeal construction, very often to the detriment, not merely of the state at large, but of the interested localities as well. For example, suppose an important market road passes through the center of County A for a distance of 10 mi., through a corner of County B for a distance of 2 mi., and through an important section of County C for a distance of 8 mi., making a total of 20 mi. It may readily happen that the counties of A and C will make application to the state for aid in the construction of this very important highway, but the interest of County B is so slight that it may refuse to apply for state aid, thus leaving an important gap which will serve to defeat the whole purpose of this road construction. The power of initiative should be vested in the state highway department, to be exercised at least in such cases as I have cited, so that there may be a definite, tangible, and useful scheme or program of construction carried out.

You are no doubt interested in knowing what steps have been taken to put the Federal Aid Road Act into operation. First the rules and regulations have been issued as called for by the act, and all of you have no doubt read them. Second the certificates of apportionment, showing the amounts credited to each state for the fiscal years ending June 30, 1917, and June 30, 1918, have been issued and these are no doubt in your possession. Two amendments to the regulations have been adopted: Amendment No. 1, merely providing that Section 1 of Regulation 6, requiring a project agreement between the state highway department and the Secretary of Agriculture to be executed previous to commencement of construction of project, should not apply to projects submitted prior to the issuance of the rules and regulations. Some projects had been submitted during the summer of 1916 and it would work a hardship to have made this regulation apply rigidly to them. Amendment No. 2 affects Section 8 of Regulation 5 and extends the date within which plans, specifications, and estimates may be submitted without conforming to a standard to be prescribed by the Secretary, to March 31, 1917. We have established ten districts for the convenient administration of the act and in each district we have established a headquarters office under the direction of a district engineer. A careful examination has been made as to the status of each of the 48 states as to whether it has a highway department within the meaning of the Federal Aid Road Act and as to whether adequate assent has been given to the terms of the act. All but a few of the states claiming to have highway departments have been upheld in their claim. In a few cases it has been found necessary to suggest the advisability of securing additional legislation to broaden the powers of the highway department. We are in correspondence with the governors of most of the states with a view to suggesting such slight additional legislation as is necessary, or in the absence of legislation to secure such assurances from the governor as will indicate the desire of the state to cooperate and the lines along which such cooperation will be established. A number of the highway departments have submitted their scheme or program of work and these schemes or programs are now receiving our careful consideration. Various stages of progress have been reached in dealing with respective states, and, furthermore, matters are moving ahead constantly and what I may say today may not represent the status of the work tomorrow. I wish to merely give you the impression that there is an active progress going on toward the establishment of definite bases for the beginning of construction when the working season opens. A number of individual projects have been submitted, but definite approval of them is for the most part delayed until the Attorney General announces his opinion as to what constitutes a rural post road within the meaning of the act. On the whole, I am much gratified at the progress that has been made in the working out of the many important preliminary questions which have been and are the subject of joint consideration by the states and the federal government. I believe that the working season of 1918 will see a large number of important projects actually under way.

Let me again emphasize more than anything else that cooperation is the governing principle in this federal aid road work and that we should approach the subject, not from different angles, but from the same angle. In other words, that which the states through their highway departments find desirable, reasonable, and necessary should be the same thing which the federal government finds desirable, reasonable, and necessary. Neither should be arbitrary, but should work together for the common interest, and I am happy in the belief that this is being done. The basic object of the federal aid road act is to improve rural transportation.

Traffic Census; Its Application to the Design of Roadways, Selection of Pavements, and Traffic Regulations

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Design of Roadway

A recent article in the "Engineering Record" deprecated taking a state-wide census on the roads in a nearby state, because such an enumeration would not necessarily indicate the roads to be improved, as travel might, for various undetected reasons, be deflected from the most economical route.

This statement serves to draw attention to the fact that the census is but one of several things to be considered in designing a road, including determining the kind of surfacing and the width, and that an inventory of all the factors affecting it must be taken before a final conclusion is reached. The writer does not believe that highway engineers are today determining roadways, or the location where main roadways of travel should be improved, solely by scanning a traffic census; there are too many other controlling conditions and the census is too little known and used, as yet, to be of much service. Nevertheless, it has a place in the design of country roads, and has loomed up recently with a large and important aspect in great cities, as will, I believe, be shown later.

In fixing the width of any roadway surface, the number of lines of traffic to be accommodated should be given consideration. The statement has been made that where a vehicle has to turn from the hard surface of a road to an earth shoulder oftener than five times in a mile, it is cheaper to construct the additional width of road surface which may be required, and is far safer.

The necessary amount of clearance which a vehicle must have to pass safely depends on the speed. The average width of vehicles in New York City has been found to be 6 ft. 9 in., large trucks occupying as much as 8 ft. or 9 ft. At slow speed, say 10 mi. per hour, with the average width, the width of a single line of automobile traffic, including clearance, would be about 8 ft., and at fast speeds 9 ft. or more. On Fifth Ave. in New York City, its busiest avenue, there are 6 lines of automobile traffic occupying 55 ft., the speed being between 5 and 8 mi. per hour. It is obvious that if the roadway had been made, say 3 ft. narrower, another line of travel—or possibly two—would have to be sacrificed. The width of the Fifth Ave. roadway was originally 40 ft., accommodating 4 lines, with too much clearance. It was widened 15 ft., and now takes 6 lines, with a safe clearance. It is obvious that great congestion would have occurred, and much inconvenience to the public, had the street continued with only 4 lines of traffic and its excessive width.

On a suburban or country road accommodating motor traffic, the additional clearance required by an overtaking car should be considered. When moving at, say 25 mi. per hour, at least 4 ft. of free way should be given the overtaken car to avoid accident due to unexpected deflection from its course. A width of 20 ft., for this reason, is better than 18 ft., for 2 lines of travel, and 30 ft. is ample for 3 lines.

In the Borough of Manhattan, a realization of the necessity for widening the narrow crosstown roadways of the mercantile district, and some of the north and south avenues as well, took shape in 1911, and has resulted since then in the widening of 14 streets and avenues 35,012 ft. in length, and apparently the work has just been begun. On all of these streets, a 10-hour census of the vehicular and pedestrian traffic was taken, and resulted in bringing to light places of unexpected congestion and afforded clues as to how the traffic can be diverted. It was found that, where the maximum number of vehicles per foot of width per minute exceeded 0.5, there was such serious congestion that a remedy needed to be applied. It was also found that where the maximum number of pedestrians per foot of width per minute exceeded 5.0, they flowed over the sidewalks into the roadway. Where both these conditions obtained, the street would need to be widened. So far, this difficulty has been obviated by clearing the sidewalks of stoops, railings, court yards, areas and other projections, thus affording additional space for pedestrians, and then widening the roadway to accommodate the suitable number of lines of travel, provided such widening did not produce an unduly congested condition for the pedestrian traffic. The traffic census has made the strongest kind of supporting data for promoting legislation for the foregoing work, and shows indisputably the need, or otherwise, of street widening.

The influence of the proportion of horse-drawn traffic on the kind of pavement, its grade, and alignment should be given weight. In cities with intensive traffic, where more than 75% is motor traffic, sheet asphalt is, in the opinion of the writer, the pavement par excellence; if the traffic is evenly divided between rubber and iron tires, wood block stands out preeminently, while, for the slow moving, horse-drawn traffic, amounting to more than 50% of the whole, close jointed granite blocks are eminently satisfactory, these limitations to be applied, of course, where traffic conditions are considered as the controlling factors in forming a decision.

The difference in traction between these three kinds of pavement, as indicated by tests shown in a pamphlet on "Tractive Resistances of a Motor Truck," by A. E. Kennelly and O. R. Schurig, may be represented by the following factors, which are averages of tractive resistances at a speed of 19 mi. per hour.

Pavement	Tractive resistances in lbs. per ton
Asphalt	19.0
Wood and brick	23.0
Granite	26.0
Macadam	22.5
Tar macadam	24.5
Gravel and cinder	26.5

The tractive resistances should, in the opinion of the writer, be given much greater weight in the selection of pavements in cities than is usually accorded them, for the following reason: It will hardly be questioned that motor trucks, in the cities at least, will soon be in almost universal use, and when this is a fact the consumption of fuel will undoubtedly be carefully examined into and smooth, light traction surfaces demanded for economy of operation. Today, with the numerous pleasure cars in use, scant attention is paid to ease of traction, grade, or consumption of gasoline, and a scenic highway is at times preferred to the shorter utilitarian route for which there is going to be an urgent demand by the motor trucks, especially in rural districts.

A few figures as to the growth of the motor truck in New York State are presented. A report of the Secretary of State states that it is estimated that auto trucks traveled over state and country highways in 1915, for 40 weeks in the year, 14,700,000 mi., and that these trucks operated 60,200,000 ton-miles. The number of auto trucks in New York State in the last three years is as follows:

1914	17,141
1915	20,880
1916	34,653

There were in New York City in 1916 about 14,000 motor trucks, double the number in 1914. In addition, there are more than 100 routes in the state over which heavy motor buses are operating, nearly all of which are less than three years old.

The surfaces which should be placed on trunk highways and rural roads for different kinds and amounts of traffic in the State of Massachusetts were outlined by Col. Sohier, Chairman of the Massachusetts Highway Commission, in a paper before the American Road Builders' Association, in 1913, on "The Traffic Census as a Preliminary to Road Improvement." Since that time the auto truck has increased greatly in number, having more than doubled in the State of New York, as shown.

Tables such as the foregoing will soon need careful revision, because of the weights and the speeds at which these trucks move. The preparedness movement has served to draw attention to the fact that it is desirable to consult the War Department as to the loads to which roads and bridges are likely to be subjected for military purposes.

The increase in the destructive effect of this traffic points to the need of much harder and more durable surfaces than have been afforded by the penetration method of construction—surfaces constructed with one course of run of crusher stone with bitumen; sand asphalt roads; broken stone, sand and bitumen roads; carpeted macadam; and other kinds of light traffic bituminous construction.

Recognition of the destructive effect of auto truck travel has recently led to a readjustment of the registration fees to a higher scale in New York State. Experience with the situation is necessary, in order to determine the exact number of commercial vehicles which may traverse economically certain types of road.

Use of the Traffic Census in the Regulation of Traffic

The traffic census finds its application to the regulation of traffic in large cities where congestion is imminent or actual. The Borough of Manhattan has found it necessary to establish 29 streets as one-way traffic streets. These are located largely in the mercantile and theater districts. Three of them are theater streets, with a one-way rule applying one-half hour before and after the termination of performances.

A determination of the amount of traffic in all the streets of any section of a city should indicate where a diversion of the flow is desirable. So far as the writer has been able to ascertain, but one study of the flow of traffic has been made, that being in the City of Bridgeport, Conn., by Alfred S. Miller, as published in "Engineering News" of Jan. 21, 1916. The writer believes that such studies are highly important where there is intensive traffic on a gridiron system of streets, to the end that alternate traffic routes may be laid out by widening, paving, regrading or otherwise improving, so that congestion may be avoided and the orderly transaction of business facilitated.

A number of the large express companies and other corporations now route their vehicles, and have a regular patrol which keeps them constantly informed of their location. A study of the flow of traffic in a large, busy city may offer some difficulties, but would be helped out by instances such as the foregoing. In the Borough of Manhattan, the Fifth Avenue Association has influenced traffic on that avenue by encouraging merchants and others to exclude commercial traffic from this distintly retail mercantile and residential thoroughfare, so that there is now less than 2% of horse-drawn vehicles of all kinds. This association makes its own traffic counts and studies traffic conditions quite independently of the city, and is in a position to make valuable recommendations as to the policy to be pursued. It was suggested to the Police Department that more time be given to the north and south traffic than to the east and west, with the result that about 45 minutes of the hour are devoted to the longitudinal travel, while the crosstown traffic takes up the remaining 15 minutes. It has been proposed to divert the through traffic of Fifth Ave. to a parallel avenue, thus affording some relief to this much congested thoroughfare.

Regulation of Pedestrian Traffic.

It is daily becoming more apparent that if the vehicular traffic is to proceed with reasonable speed, say 8 mi. an hour on our busiest streets, it will be necessary to regulate the pedestrian traffic as well. It was found that the average time taken by a woman crossing Fifth Ave.—which has a width of 55 ft.—was 11½ seconds. In the busy hours, 6 vehicles would pass in that time, rendering the crossing difficult and dangerous. There is nothing to prevent a pedestrian from crossing the street at any time he may elect to do so, but he certainly needs to be told when, if the number of accidents which happen is a criterion.

The subject matter of traffic regulation can be only touched on at this time. State-wide cooperation, to the end that uniform regulations may be drafted and legislated into laws, is much needed. Attention is directed to the proposed regulations of the State Bureau of Municipal Information of the Conference of Mayors of New York State, embodying the ideas of those most interested in that state. It does not, however, cover the matter of the regulation of the size, weight or construction of the vehicle itself, which is of great interest to the highway engineer.

As to What the Census Should Include.

The traffic census should include observations as to the direction of the flow of traffic, such as left-hand turns; number of vehicles emerging from, or entering side streets; routes of mail trucks and other vehicles; wandering cabs, etc., as well as a knowledge of the various classes of vehicles, if the congestion features of traffic are to be studied. The points at which the count should be taken are worthy of study, and this study is best made by plotting bands of different colors and widths along the roads or streets where the census has been taken. Work of this kind has an intimate relation to building district restriction plans, and to the city plan generally.

Uniformity in methods of taking and recording counts, and in the assignment of weights, is much needed for comparisons in different sections. Some office work can be saved by the use of standardized forms, and the writer would suggest that this matter be given attention by the Committee on Standards of this society, and that the cooperation of other engineering societies be sought in making such forms.

In conclusion, the writer would direct attention to the fact that the traffic census has a wide application to city work in the selection of pavements, street widening, the removal of encroachments, traffic regulation, fixing values of property, opening of new or extension of old streets, operation of street railroads and buses under franchises, determination of the amount of wear of various kinds of pavement under known weights of travel, regulation of the dimensions, weights, etc., of vehicles, and the determination of a paving policy.

List of References on the Traffic Census.

ROAD AND PAVEMENT DIMENSIONS, ETC., by Linn White, Proc., A. R. B. A., 1914. (Design).

ROAD IMPROVEMENT. By W. A. McLean, Proc., A. R. B. A., 1914. (Design).

COMPARISONS OF TRAFFIC AND THEIR ECONOMIC VALUE. By Linn White, Proc., Pan-American Road Congress, 1915; also discussion by H. K. Bishop.

WIDTH AND ARRANGEMENT OF STREETS. By Charles Mulford Robinson, 1911. (Effect of traffic on design of streets).

ENGINEERING NEWS. Vol. 76, p. 832.

GOOD ROADS. Jan. 3, 1914; p. 45.

INTERNATIONAL ASSOC. CHIEFS OF POLICE. Proc., 1915, re. Regulations for street traffic.

SAFETY FIRST ASSOCIATION OF AMERICA. Re. Proposed Traffic Regulations as Amended April 20, 1916.

THE PLANNING OF THE MODERN CITY. By Nelson P. Lewis (Design).

THREE YEARS' GROWTH OF STREET TRAFFIC IN NEWARK, N. J. By Harland Bartholomew. "Engineering News," Sept. 16, 1916.

SCHEME FOR GRADUATION OF STREET TRAFFIC. "Engineering News," April 20, 1916.

REPORT OF THE CITY ENGINEER OF SEATTLE, 1915. "Engineering News," April 27, 1916.

FORMS FOR REPORTING PAVING HISTORY AND TRAFFIC. "Engineering News," Vol. 75, No. 10.

METHODS OF TAKING TRAFFIC CENSUS ON HIGHWAYS. By A. H. Blanchard, "Engineering News," Mar. 2, 1911.

DISTRIBUTION OF TRAFFIC ON A RECTANGULAR SYSTEM OF ROADS ANALYZED. By E. W. James, "Engineering Record," Oct. 7, 1916.

CHICAGO TAKES TRAFFIC CENSUS OF THE LOOP. "Engineering Record," Vol. 72, No. 12.

REGULATION OF WEIGHT, SIZE AND SPEED OF VEHICLES HAS BECOME AN ALL-IMPORTANT PROBLEM. By H. C. Hutchins, "Engineering Record," June 17, 1916.

TIDE OF MOTOR TRANSPORTATION RISING FAST. By H. C. Hutchins, in "Automobile Topics," July 29, 1916.

PLANNING FOR FUTURE TRAFFIC ON TRUNK HIGHWAYS. "Municipal Journal," Sept. 21, 1916.

PUBLIC ROAD MILEAGE AND REVENUES IN THE MIDDLE ATLANTIC STATES. U. S. Dept. of Agri., Bulletin, 386, Sept. 11, 1916.

ROAD TRAFFIC, "Engineering," Sept. 1, 1916.

IMPROVEMENTS OF HIGHWAYS TO MEET MODERN CONDITIONS OF TRAFFIC. By W. H. Scofield, "Soc. Mun. and County Engineers," July 21, 1916, and "I. M. and C. E. Journal," July, 1916.

PRACTICAL STREET CONSTRUCTION. By H. C. Hutchins, "Municipal Journal," March 9, 1916.

THE ADAPTABILITY OF ROAD PAVING MATERIALS TO DIFFERENT CONDITIONS AND LOCALITIES. By F. C. Pillsbury, "Good Roads," March 4, 1916.

WIDTH AND ALLOCATION OF SPACE IN ROADS. By F. Longstreeth Thompson, "Surveyor."

SYSTEMS OF TRAFFIC CONTROL. By H. C. Hutchins, "Municipal Journal," May 25, 1916.

THE AUTOMOBILE AND THE CITY PLAN. By Nelson P. Lewis, "Engineering Record," June 10, 1916.

HOW CITY PEOPLE TRAVEL. By Roger W. Toll, "General Electric Review," January, 1916.

THE DOWNTOWN BROOKLYN TRAFFIC PROBLEM. By W. H. Messenger, Proc., Brooklyn Engineers' Club, 1914.

METHODS OF TAKING TRAFFIC. "Engineering News," Nov. 10, 1914.

STREET TRAFFIC IN NEW YORK CITY IN 1885 AND 1904. By Clifford Richardson, Trans., American Soc. C. E., Vol. 57, p. 181, Dec. 1906.

TRAFFIC CENSUS ON HIGHWAYS. By L. I. Hewes, "Engineering Record," May 17, 1913.

THE TRAFFIC CENSUS AS A PRELIMINARY TO ROAD IMPROVEMENT. By Col. W. D. Sohier, "Good Roads," Jan. 4, 1913, vol. 5, p. 40.

A PROPOSED STANDARD RECORD FOR STREET TRAFFIC. "Engineering News," Jan. 2, 1913.

ROAD TRAFFIC CENSUS. Report of the New York State Commission of Highways, 1910.

A CITY STREET TRAFFIC INVESTIGATION; BRIDGEPORT, CONN. By Alfred T. Muller, "Engineering News," Jan. 21, 1916.

DRAFT OF A PROPOSED CODE OF TRAFFIC REGULATIONS FOR CITIES IN NEW YORK STATE. By the State Bureau of Municipal Information, December, 1916.

HIGHWAY CONDITIONS IN THE PIONEER GOOD ROADS STATE UNSATISFACTORY. "Engineering Record," Nov. 18, 1916.

TRACTIVE RESISTANCES TO A MOTOR DELIVERY WAGON. By A. E. Kennelly and O. R. Schurig, Bul. No. 10, Elec. Eng'ng. Dept., Massachusetts Institute of Technology, June, 1916.

THE MOTOR TRUCK AND THE ROAD. By Nelson P. Lewis, "Engineering Record," Jan. 6, 1917.

TRAFFIC STATISTICS. By E. P. Goodrich, Proc. of the First Annual Convention of the Safety First Federation of America.

The Layout of Park Roadways*

By George L. Nason.

In park work and on private estates roads and paths are generally determined on plan and these lines are roughly laid out on the ground by the most available method, as, from existing buildings, from topography or from a cross section survey, perhaps. These rough lines are then restaked and smoothed out by the eye. The park curve is the curve found in nature, namely, some form of spiral. The curves of practically all growing things are in spiral form and this is probably the reason that the spiral appears the natural curve to best fit ground forms. Thus the curved park road should always be either increasing or decreasing in degree of curvature where a naturalistic effect is desired. Of course, if it is a formal piece of park work that is another matter. Another empirical rule is that there shall always be a piece of tangent between two reversed curves, as this tends to give a strong, virile line, and, on the other hand, that between two curves going in the same direction there never should be a piece of tangent, as this will give a weak line and a somewhat broken-back effect to the curves involved. These three rules are the principal points to remember in the use of curves, not only for roads, but in general artistic design.

In the residence subdivision, however, circular curves are used. The application of the complete spiral curve to a residence subdivision, while admittedly prettier than the regular circle, has, so far as I know, never been well solved. First, there is the difficulty in the mathematical description of a curve of this type, and, second, the complexity of computation that it would involve. The approximation of the spiral by the use of compound curves is as far as I have ever gone in the effort to obtain such a result. The matter of legal description with regard to property lines is very important, and a great complexity in curves is bound to lead to error in the original staking out and in future lot surveys.

In some of the older curved subdivisions the matter of description has been very loosely done, and today it is very difficult to determine just where a lot line comes. This is due to the fact that many of these are laid out by determining the curves on the ground—by simply measuring on the ground to determine plat dimensions. * * *

It is always best that two streets should intersect at a piece of tangent, even when this involves the placing of such a section between two curves going in the same direction. There are many economies in this, such as future computation of curb intersections, etc., as well as immediate ease in the determining of the intersection of the street center line. Further, it seems to be a wise provision of nature that unless there is a short piece of tangent visible before the curb line crosses the intersecting street, the eye does not seem able to carry the curved line across in perspective, and apparently there is a sharp break in the curve, the eye seemingly having a tendency to carry on the line of the curve on a tangent from the point of breaking off. Thus if we have a short piece of tangent on each side of an intersecting street, the eye will carry the line across on a tangent and no feeling of break will occur. At times, however, an intersection will take place on one side of the street only, and, if this is a curved street, a flat piece of tangent on the opposite side would be the more apparent of the two evils. Then it becomes necessary to have a curved intersection. This will involve the determination of the equation of the lines involved and the solution by analytic geometry for the points required.

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* From a paper read before the Civil Engineers' Society of St. Paul, November, 1916, printed in "The Bulletin" of the Affiliated Engineering Societies of Minnesota, January, 1917.

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Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

FEBRUARY 17, 1917

THE A. R. B. A. CONVENTION AT BOSTON

The prediction made in this column two weeks ago that there was everything to indicate that the Boston convention of the American Road Builders' Association would "equal, if not exceed, in interest and value" previous meetings held under the auspices of the association was fully justified by the events in Boston last week.

To the visitor at the congress probably the most striking feature was the display of road machinery, materials and methods. This comprised over one hundred separate exhibits, commercial and non-commercial, the former being made by leading manufacturers and dealers in the road machinery and material field and a representative number of motor truck manufacturers. The machinery display comprised the usual great variety of equipment, ranging from heavy mixing plants and driers to small hand tools. In like manner the materials exhibited included almost everything that goes into the construction of modern roads and pavements. Mechanics Building, where the show was housed, not only afforded ample space, but also offered every opportunity for the attractive display of the various exhibits. Inquiry among the exhibitors and the comments heard during and after the convention evidenced the satisfaction with which the exhibitors regarded the arrangements made for them and the opportunity for putting their products before road builders.

From the technical point of view the convention was no less successful. An admirable arrangement of the program had been made, which, as has been previously pointed out, reduced the number of papers to the minimum for the proper presentation of each topic and allowed the maximum time for open discussion. The attendance at the technical sessions was unusually large and did not manifest the discomfiting feature of dwindling toward the end of each session and toward the end of the convention, as is too often the case at meetings of the kind with sessions sometimes three hours in length. Another feature that contributed to the interest in this part of the congress was the presence of a number of speakers new to A. R. B. A. meetings, with the consequent treatment of the various subjects from new angles. Participation in the discussion following the presentation of the papers was very general and at times spirited enough to awaken much more than ordinary interest. One feature that greatly enhanced the value of the sessions was the exceptionally comfortable and convenient meeting place.

The attendance was everything that could have been desired, both in number and character. The total registration is understood to have been some four thousand, and it is certain that this attendance consisted almost wholly of actual road builders and those directly engaged in the work of road building. The importance of this feature should not be overlooked in an estimate of the practical value of a meeting of the kind, for the attendance at so many conventions is swelled by the presence of large numbers who have only a passing interest in road betterment or who are merely "enthusiasts" or "boosters," who, while performing a very necessary part in the work of road improvement, are not those who can benefit most by the opportunity afforded by an excellent technical program and a comprehensive and up-to-date exhibit of materials and equipment.

No comment on the Boston meeting would be complete without at least passing reference to the social and entertainment features of the meeting. The annual subscription dinner of the association attracted about 450 delegates and guests—a larger number than in any other year—and proved a most enjoyable feature. The ball—an innovation this year—was by all means the most distinctive social affair held in connection with the convention or any A. R. B. A. convention in preceding years. In addition to these two events there were a smoker given under local auspices and a number of lesser entertainments and trips arranged by the local committees, most of these being for the entertainment of the ladies present.

While credit for the success of the convention must, of course, be given chiefly to the officers of the association having the arrangements in charge, a large part of the pleasure of those in attendance was due to the hospitality and energy of the local officials and citizens who cooperated with the association.

NEWS NOTES

The Mountain Road to Mount Tacoma and the National Park, Washington, is being improved as rapidly as possible, according to reports. Plans of County Engineer David H. White provide for the paving of a 6-mi. section on the upper end of the road, starting 3 mi. beyond Ashford. About 11 mi. have been paved on the Tacoma end of the road.

The National Assembly of Panama has passed a law authorizing the President to enter into an agreement with the United States for the construction of roads and railroads throughout the country, the two governments to bear the expense equally. The roads, etc., constructed under this law will be managed and maintained by a joint commission of Panamans and Americans.—*"Commerce Reports," U. S. Department of Commerce.*

The Injection of the Highway Question, when Accompanied with Money to Use and Places to Fill, into Politics has a remarkable effect upon the latter. It causes the political body to wax fat and "sassy"; to take a new lease of life and spread like the "green bay tree." Its effect upon the highways is fully as remarkable but of a very different nature. The actual monetary loss to the state because of changes in the department due to political changes in the state government is a large percentage of the total cost of the work. It lowers efficiency, causes duplication of work, increases the primary cost and frequently delays either the design or construction, or both.—*From "Highway Construction," a paper by Theron M. Ripley, Division Engineer, New York State Highway Commission, printed in the "Quarterly Journal" of the Montana Society of Engineers, Vol. 1, No. 4.*

Use of Patented Pavements on Federal Aid Roads

Discussion on the Subject at the Boston Convention of the American Road Builders' Association

An issue which, as federal aid becomes a factor of importance in the construction and maintenance of roads, may be the cause of no inconsiderable difficulty was discussed at some length at the fourteenth annual convention of the American Road Builders' Association at Boston last week. The question, that of the use of patented pavements on roads paid for in part by federal funds, came up on the first day of the meeting, following the presentation of a paper entitled, "Policy and Program of Government in Road Construction under the New Federal Aid Law," by Logan Waller Page, Director of the Office of Public Roads and Rural Engineering, U. S. Department of Agriculture. A resolution requesting the Secretary of Agriculture to rescind a part of the rules and regulations for the administration of federal aid work was presented and referred to the Committee on Resolutions. At a later session the committee reported adversely upon it and, after a discussion given in detail in the following pages, the resolution was tabled.

The entire discussion hinged on one section of the rules and regulations prepared by the Secretary of Agriculture. This clause (Regulation 8, Section 4) is as follows:

> No part of the money apportioned under the act shall be used directly or indirectly to pay or to reimburse a state, county or local subdivision for the payment of any premium or royalty on any patented or proprietary material, specification, process, or type of construction, unless purchased or obtained on open, actual competitive bidding at the same or a less cost than unpatented articles or methods equally suitable for the same purpose.

A portion of the law which would seem to cover this point, and was so invoked in the discussion, is as follows:

> The construction work and labor in each state shall be done in accordance with its laws, and under the direct supervision of the State Highway Department, subject to the inspection and approval of the Secretary of Agriculture and in accordance with the rules and regulations made pursuant to this act.

The discussion which followed the presentation of Mr. Page's paper was as follows:

Discussion on Paper, "Policy and Program of Government in Road Construction under the New Federal Aid Law," by Logan Waller Page

L. D. SMOOT (Street Commissioner, Jacksonville, Fla.): I would like to ask a question, if I may. Do you understand that Regulation 8, Section 4 of the rules and regulations of the Secretary of Agriculture with respect to patented and proprietary articles practically prohibits the use of such patented or proprietary articles?

LOGAN WALLER PAGE (Director, Office of Public Roads and Rural Engineering, U. S. Department of Agriculture): No, if you will read the rest of the section you will see that it does not. They must come under actual competition.

MR. SMOOT: Then do I correctly understand that this is a rule and regulation of the Secretary of Agriculture which may be rescinded by him if the actual operation in any particular case, or in general, proves impracticable?

MR. PAGE: I think that all of the courts have ruled that any official who has authority to promulgate rules and regulations has authority to suspend them and to revise or alter them.

MR. SMOOT: In other words, this rule could be rescinded by the Secretary of Agriculture in case it was found to work against the state law? For instance, I know that in the case of some state laws the plans and specifications for the material, under which a road must be built, have to be filed prior to the advertisement for the road. Now, that would prohibit a patented pavement being put on the list of pavements which would receive federal aid. That would be my construction. I would like to ask if that is your opinion, under the section?

MR. PAGE: Of course I am not the legal authority. I have no power to adjudicate the law nor the rules and regulations which have the power of law as long as they exist, but any patent or proprietary material may come in under the provisions of Section 8 if it is subjected to actual competition.

PRESIDENT DEAN: Is there any one else who has any questions to ask or remarks to make relating to this federal aid law?

I think Mr. Reed of New Jersey had some remarks that he wanted to present. Mr. Reed has a paper, prepared by Col. Stevens, who was unable to be present, that he will now read.

EDWARD E. REED (Division Engineer, New Jersey Department of Public Roads—Reading written discussion by Col. E. A. Stevens, State Commissioner of Public Roads of New Jersey): I do not believe that any discussion of this subject would be complete without a solemn protest against Regulation 8, Section 4. This section, which refers to the use of patented or proprietary materials or processes was adopted after the Association of State Highway Officials had been informed that it would have to stay in spite of that body's previous unanimous vote advising its omission. The association, on being thus informed, suggested, by a divided vote, changes providing for competition. Such competition is impossible in the case of meritorious patents under any strict interpretation of the language used. As published, the section represents the mind of the government officials modified by a somewhat obscure and, in execution, impracticable, proviso suggested by some of the state officials to relieve the obvious objections to the section.

The legality of the regulation has been questioned. It is asked whence the Secretary of Agriculture derives the powers he proposes to exercise. This question can well be left to those better qualified to discuss it. That it can be raised at all is unfortunate. It is always regrettable for a leader to so perform his duties as to raise doubts in the minds of those under him as to the legality of his actions. Nothing is more subversive of discipline and cooperation. Cooperation to a common end and the discipline necessary therefor, possible under a wise administration of the Federal Aid Act, are made harder if not prevented by such needless controversies. To my mind, the gain possible from cooperation is as great as that due to United States appropriations.

I fear the loss of any general desire to cooperate and in my own case can bear evidence thereto.

The object of the section objected to is clear. The Patent Office issues many unnecessary patents. There are but few who can grasp the engineering issues raised in patent suits. Expert witnesses in patent cases are most skillful. In a word, patent practice among us is in a deplorable state. Patents create lawful monopolies; that is their object. Some patentees will and do abuse their rights. Granting all of the above, the attempt to cure these evils by the proposed regulation is ill-advised.

If the Patent Office and the courts do not do their work satisfactorily, the remedy is obvious. Any attempt of another department to "butt in" cannot bring about a millenium and involves serious possibilities.

As an American citizen I object to the government's stultifying itself in such a way. Under the very inexact and indefinite language used, and under the very full powers vested in the Secretary of Agriculture, there is no way of foretelling how the section will be interpreted. If, through the doubt thus created, if not by some definite ruling, any right dealing patentee of a meritorious "material, specification, process or type" is excluded, an injustice is done him on account either of the alleged wrongdoing of others or the untrustworthiness of the Patent Office. This is the denial to him by one department of a right conferred by act of Congress and the decision of a coordinate department.

But even if there be no such thing as a "right dealing patentee," there are some meritorious patents and their use can be had on reasonable terms by honest and competent road officials. The practical denial of the right to bargain for such use would seem justifiable only on the assumption that state officials are either dishonest or incompetent. Such assumptions do not promote cooperation and team-work.

The attempted regulation is useless. Its object, the prevention of the abuses that have but too often been characteristic of the marketing of patented pavements, can be much better attained by action in each case as it arises. The language used has no exact meaning. What is covered by "used directly or indirectly, to pay or to reimburse a state * * * * for the payment of any premium or royalty?" What does "equally suitable for the same purpose" mean? Who is to say what is equality and what is the purpose?

Then, too, what is "open actual competitive bidding?" In several states such bidding calls for closing the specification to all but the patented type if that is the one desired. There is also a disregard of definiteness.

Under the circumstances, there will be but one safe course to follow and that is to cut out the use of any patented or proprietary article. This is unfair, unprogressive, un-American, but it will be the only safe thing to do if one wants to keep cost within the appropriation, and failure to do this is generally noticed in criminal legislation.

I have possibly been unduly impressed with the greatness and difficulty of the road problem to this nation. I cannot, however, escape the conviction that this problem demands not only our best talent, but the hearty cooperation and teamwork that can be made effective only through a central control. With our federal system of government, this control must rest largely on loyalty to the central body and to those controlling it. This implies confidence and confidence must be mutual. It is on the danger to this, in my mind, essential foundation of any thorough solution of our road problem that my objection to Regulation 8, Section 4, is mainly based. It is as to reality of this danger, not only in my own state, but in others that I feel called on to bear witness in unmistakable words.

I hold no brief for any patentee; in most cases I am opposed to the use of patented materials, etc., but I do protest against an administrative policy that imperils, if it does not destroy, the reason that led me for one to champion the federal aid act. It is unfortunate that other details of federal administration have tended, not to lessen the bad effects mentioned, but rather to intensify what at first appeared to be an almost unwarranted inference as to the spirit in which federal authority was to be exercised.

F. A. REIMER (County Engineer, Essex County, N. J.): I am very glad that the State of New Jersey has such an able state road commissioner. He has expressed his objection to this clause forcibly and in plain language. I want to take exception myself to any clause which will bar from the engineers of the State of New Jersey and elsewhere the rightful initiative which they should hold at all times with the suggestion as to the type of pavement to be used, irrespective of whether it is a patented article or not. I do not consider that there is a proper place in any legislation or in any rules of any department for proscribing the possibility of the engineer recommending to his board the use of any material when it is based on his honest and proper opinion. I cannot conceive of anything more difficult for the government department to attempt to say than that the engineers of the respective localities are not competent to select the type of material which should go on the roads. We have certain specific localities to operate in and the governing bodies of those localities depend upon us to submit to them our recommendations. We should have the right to say to our boards, in specific language, that we recommend the use of this material or that material. It destroys absolutely, in my opinion, proper competition. To me there is nothing more pernicious in practice today than the letting of contracts in which you throw wide open the possibility of getting bids on all types of material, including those which are not patented, with the patented material. It is the most pernicious policy we have by which you can introduce log rolling in the governing boards after the bids have been received when it will invariably be true that the unpatented will be lower in price than the patented article and the engineer who has made the recommendation is put immediately at a disadvantage and often his recommendations are ignored—not because they are not right, but because of log rolling which has taken place after the bids have been received. I certainly trust that if this regulation is in the rules at the present time, which I understand it is, the government department, through Mr. Page, will see to it that certain amendments are made by which our engineers of all our governing boards may select the materials which they believe are the proper materials in view of the nature and extent of the traffic in their respective localities, for they are certainly better able to judge those conditions than anybody else.

MR. PAGE: Gentlemen, I must say that I am rather surprised at Col. Stevens' remarks, because at the meeting we held on the 16th of last July—where all the state highway departments, I think, but one were represented—there was not one word said against this regulation. I must say I don't know of any state highway department in the United States that uses patented materials, except New Jersey. Many of our city governments require open competition and I think it is nothing more than fair that open competition should be required in this. When a patented material is selected, competition is closed. And as for your talk about log-rolling, I suppose there is no log rolling of patented materials, is there? I think we are all pretty familiar with that. I think it is absolutely the only stand the government can take, and as far as I am concerned I shall never recommend to the Secretary of Agriculture—he has the power to rescind the regulation—I shall never recommend to him that the regulation be rescinded. I believe every state highway department will be with me on it.

J. M. HEAD (Attorney, Warren Brothers Company): I wish to say a word as to the construction of the federal aid road act and the regulation adopted by the Secretary of Agriculture for carrying that act into effect.

It is well known that prior to and pending the consideration of this act and others pending before Congress at the same time, there were serious differences of opinion as to the power of Congress to use federal funds in the construction of roads in the several states, or to use federal funds to aid the several states in building roads therein. It was finally decided that under that provision of the Constitution which empowered Congress "to establish post offices and post roads," federal funds could be used for this purpose. Accordingly, the first section of the federal aid road act expressly provides that:

> The Secretary of Agriculture is authorized to **cooperate** with the states through their respective highway departments in the construction of rural post roads.

Section 6 of this act further provides that:

> Any state desiring to avail itself of the benefits of this act **shall by its state highway department** submit to the Secretary of Agriculture project statements setting forth the proposed construction of any rural post road or roads therein.

This section also provides that:

> The construction work and labor in each state shall be done **in accordance with its laws** and under the direct supervision of the State Highway Department, subject to the inspection and approval of the Secretary of Agriculture, and in accordance with the rules and regulations **made pursuant to this act.**

This section also provides that:

> The Secretary of Agriculture shall approve **only such projects as may be substantial in character**, and the expenditure of funds hereby authorized shall be applied **only to such improvements.**

Section 7 of this act provides:

> To maintain the roads constructed under the provisions of this act **shall be the duty of the states** or their civil subdivisions, **according to the laws of the several states.**

This section further authorizes the Secretary of Agriculture, if at any time thereafter he finds that the roads for which the state pays one-half the original cost of construction are not being properly maintained by the state, to give notice of such fact to the highway department, and if not put in proper condition within four months thereafter the Secretary is authorized to refuse to approve any project for road construction in that state until the roads are put in proper condition.

There is no provision, express or implied, anywhere in this act which undertakes either to favor or discriminate against any projected improvement or the plans and specifications therefor which may be submitted by the highway department of any state in the Union. The sole purpose of this act was to have the Secretary of Agriculture cooperate with the highway departments of the several states in the construction and building of post roads in that state, "the construction work and labor in each state to be done in accordance with its laws and under the direct supervision of the state highway department," the control of the Secretary of Agriculture over the federal funds being to either approve or reject the project, plans and specifications submitted by the state highway department and inspect the work as it was being done by the highway department "in accordance with the provisions of the law in force in each state," and he was expressly authorized to withhold federal aid **only** if such projects and plans were not **"substantial in character."**

It is difficult to see how any reasonable construction of the power conferred upon the Secretary of Agriculture by this act to control the use of the federal funds can have any other or different interpretation than that above given.

However, in pursuance of that provision of the act which confers upon the Secretary of Agriculture the power "to make rules and regulations **for the purpose of carrying out this act.**" Regulation 8, Section 4, was adopted, which is as follows:

> No part of the money apportioned under the act shall be used directly or indirectly to pay or to reimburse a state, county or local subdivision for the payment of any premium or royalty on any patented or proprietary material, specification, process, or type of construction unless purchased or obtained on open, actual competitive bidding at the same or a less cost than unpatented articles or methods equally suitable for the same purpose.

In a number of states the laws expressly provide that the final determination of the kind and character of improvement, whether patented or unpatented, shall be determined upon and specifications therefor adopted before advertising for bids.

This regulation presumes, in the face of express state laws and state supreme court decisions, that bids can be called for on both patented and unpatented articles before selecting the kind of improvement to be made, and also assumes that some unpatented article is, in the opinion of the Secretary of Agriculture, "equally suitable" for the proposed construction, notwithstanding the fact that before a valid patent can issue from the Patent Office, or be sustained by the courts, it must be for "a new and useful invention" and different from any other form of construction then known.

This regulation further presumes that the several state highway departments will not for some reason act efficiently and wisely under the several state laws which they are authorized to carry out.

If the provisions of this act do require that before any portion of the federal funds to which a state may be entitled can be used upon a project and under plans and specifications which the state highway department purposes must meet the approval of the Secretary of Agriculture, then this regulation is wholly unnecessary and should be rescinded, since it undertakes to determine in advance of any consideration whatever that "any patented or proprietary material, specifications, process or type of construction" will not be approved by the Secretary of Agriculture, no matter how meritorious it may be, unless it can be purchased at the same or a less cost than some unpatented article or method of construction which, in the opinion of the Secretary of Agriculture, is "equally suitable for the same purpose."

No such unjust discrimination as this is attempted to be made against any other project, specification, process or type of construction which a state highway department may submit, and certainly should not be against an article for which a patent has been issued by one department of the government, and its validity passed upon and approved after thorough investigation by another department.

Certainly this matter can safely be left where the federal aid act itself leaves it, that is, with the several state highway departments, under the different state laws, which have already determined the advisability of using patented or proprietary articles under laws which provide the necessary competitive bidding now required, the Secretary of Agriculture having at all times the power to approve or disapprove every project, plan and specification submitted by a state highway department.

MR. PAGE: I think that the government and the state highway departments can conduct their cooperative work without the advice of any patented material company. That is all I have to say.

PRESIDENT DEAN: Gentlemen, I fear I will have to postpone this discussion. We have another important subject. Mr. Head has covered this subject very thoroughly. I cannot see how much else could be said, so we will pass along, if there is no objection, to the next paper on the program * * * * *

MR. SMOOT: Mr. President, I don't want to break in on this, but do I understand there will be no further discussion on the last subject?

PRESIDENT DEAN: We will try to arrange to have further discussion if we can have it when Mr. Page can be present.

MR. SMOOT: Would it be out of order to introduce a resolution at the present time relative to the article under discussion?

PRESIDENT DEAN: The resolution would be received and referred to the Committee on Resolutions for its action.

MR. SMOOT: Then I would like to introduce the following resolution:

> RESOLVED: That the Secretary of Agriculture be and be hereby is requested to rescind Regulation 8, Section 4, leaving the matters therein contained where the act itself leaves them, to wit: "The construction work and labor in each state shall be done in accordance with its laws and under the direct supervision of the State Highway Department, subject to the inspection and approval of the Secretary of Agriculture."
>
> RESOLVED: That the Secretary of the American Road Builders' Association transmit a certified copy of these resolutions to the Secretary of Agriculture, with urgent request for immediate and affirmative action thereon.

PRESIDENT DEAN: In accordance with the by-laws this resolution is referred to the Committee on Resolutions for its action and later report.

Discussion Following Report of the Committee on Resolutions on the Resolution Offered by Mr. Smoot.

PRESIDENT DEAN: I think the Resolutions Committee has a report to make.

J. W. HUNTER (First Deputy Commissioner, Pennsylvania State Highway Department): Mr. Chairman, the resolution that was offered by Mr. L. D. Smoot, of Florida, was referred to your committee, and your committee has given the matter of this resolution careful consideration and recommends that it be not adopted.

F. A. REIMER (County Engineer, Essex County, N. J.): May we have the resolution read?

PRESIDENT DEAN: The resolution is as follows:

RESOLVED: That the Secretary of Agriculture be and be hereby is requested to rescind Regulation 8, Section 4, leaving the matters therein contained where the Act itself leaves them, to wit: The construction work and labor in each state shall be done in accordance with its laws and under the direct supervision of the State Highway Department, subject to the inspection and approval of the Secretary of Agriculture.

RESOLVED: That the Secretary of the American Road Builders' Association transmit a certified copy of these resolutions to the Secretary of Agriculture, with urgent request for immediate and affirmative action thereon.

Is there anything to be said on the question?

GEO W. TILLSON (Consulting Engineer to the President of the Borough of Brooklyn, New York, N. Y.): I move the adoption of the report.

O. F. WINSLOW (Street Commissioner, Nashua, N. H.): I second the motion.

PRESIDENT DEAN: It is moved and seconded that this resolution be not adopted.

MR. REIMER: Mr. Chairman, I don't feel like letting that motion go without a remark from me. I spoke strongly against the regulation as set forth, and I have not changed my opinion at all since that time; if anything, I am more convinced than ever of the desirability of effecting a change in the regulation by which we will not be restricted in our various states and communities as set forth in that regulation. I feel that it handicaps officials and it takes from them their right of opinion and recommendation in a way which to me is entirely wrong. I feel that this association would dignify itself in going on record in requesting the Secretary of Agriculture to reconsider this regulation, and see if the matter could not be put in such shape as not to be a hindrance to some of the states in this Union. I, however, recognize the fact that the committee to which this resolution was referred has spent time in giving it the consideration which it deserved, and I feel that they have gone into all the phases of it, and while I still adhere to my opinion, I concur in the motion made by Mr. Tillson.

GEO. C. WARREN (President, Warren Brothers Company): Mr. President, I don't wish to press the passage of this resolution but I would like to call your attention and through you the communities which you represent to the fact that the great State of New York, under an opinion rendered by its attorney general, is absolutely prohibited from using any patented or proprietary article, if the regulation is carried out. The circumstance of the opinion to which I refer was in one of the cities of Northern New York operating under the present state highway law under which bids were received for a patented pavement in competition with a brick pavement. The patented pavement was the lowest in price. The local community paid a very large percentage of the cost and petitioned the State Highway Commissioner to award the contract for the lowest bid, being a patented pavement. Parties interested in the other pavement raised a serious question of law as to whether or not the State Highway Commission was correct under the law of the state, with respect to highway contracts, in receiving bids for two kinds of pavement in competition with each other. In most unmistakable terms and in a very exhaustive opinion the attorney-general stated that under the state highway act of New York it was the duty of the State Highway Commission to determine the kind of pavement before it received bids and that, therefore, all the proceedings leading up to the letting of that contract were absolutely void. Since that time the State Highway Commission has always followed the rule laid down by its attorney-general that it must determine the kind of pavement before it received bids. Now, I submit to you, gentlemen, in all seriousness, that the State of New York, and I believe fifty per cent. of the other states, are absolutely prohibited from taking bids on two kinds of pavement, and this regulation says that if the state desires to use a patented or proprietary article, bids must be received in competition with some other article. It is not a question of any patented or proprietary article in existence today; but if, for instance, Mr. Page, the Director of the Office of Public Roads, secures a patent, for which he has an application now pending, for a certain type of pavement made of a combination of cast iron and rock, it will be the most expensive pavement that is on the market. It may be the very best one that is on the market, but I submit that there is no other type of pavement which could be put in competition and that patented pavement be lower in cost however good it may be. As I said, I don't want to press the passage of this resolution. The committee has acted in good faith, but your very earnest consideration should go to your communities, and I wanted to call your attention to those facts.

[The following are extracts from the opinion of the Attorney-General of New York, to which reference is made in the foregoing.]

This does not contemplate bids upon specifications for two or more different classes of construction for the same contract. It does not contemplate that the final adoption of the specifications shall be after the bids have been made and opened. The advertising for proposals is not to be made until after the final adoption of the specifications * * * * *

From this it seems clear that the kind of improvement desired by the village should be decided and the specifications prepared accordingly before any advertisement of or proposals is done * * * * *

I think that no advertising for bids should be done until the village has decided what kind of pavement it wants and the specifications therefor are prepared and finally adopted, and that it is improper to ask for proposals or bids in the alternative on different classes of construction, one of which must always of necessity be more expensive than the other * * * *

Any variation of these provisions, so wisely adopted, is wholly illegal and in my opinion the action taken in permitting alternative bids for different materials, resulting in proposals for improved highways of widely different character, is entirely outside the scope and permission of the statute under which the funds were appropriated by the people.

PRESIDENT DEAN: Any further remarks?

NELSON P. LEWIS (Chief Engineer, Board of Estimate and Apportionment, New York, N. Y.): Mr. President, in the City of New York, we are hedged about by a charter provision which says that: "Except for repairs no patented pavement shall be laid except under such circumstances that there can be a fair and reasonable opportunity for competition." The reasonableness of the competition is to be passed upon by the governing body of the City of New York, the Board of Estimate and Apportionment. The reason that this provision was inserted in the charter was that at one time in the history of the city its people suffered from the rather reckless policy of laying patented types of pavement. I know that one city in New Jersey was practically bankrupted by the laying of pavement of that particular type. It has been somewhat of a handicap. I have often felt that the City of New York ought to have the right to use a pavement which seemed to be best adapted to any particular condition, and yet I realize that there is need for conservatism, and for the careful protection of the tax-paying public, and I cannot but believe that after all we have gotten along fairly well under that restriction.

I have noticed a number of times in sitting in this hall, the legend up over the arch: "Be just and fear not." Now, where lies justice? Justice to whom? We want to see justice to the man who will devise a good, durable pavement, one which is suited to peculiar conditions, and he should have a fair chance to use such material; we want justice also to the taxpayer, to the government which is providing many, many millions for road improvement, and I feel that the action of this body in urging the rescision of this provision in the regulations devised by the Secretary of Agriculture in connection with this enormous expenditure might be—I will not say subject to misconstruction, for if we are just we should fear not—but I believe that it would be a questionable thing, an inexpedient thing, for this association to urge the Secretary of Agriculture to rescind or to omit from his regulations a provision which undoubtedly has been adopted after the fullest and most careful consideration. I believe that there should be no insuperable difficulty in securing such a reasonable degree of competition between patented and unpatented pavements as would conform with the letter, or, at any rate, with the spirit of this regulation.

It may be that we have got to provide competition between pavements of the same class. I admit, gentlemen, we have failed several times when we have tried this. I, myself, tried to devise a specification for paving a street in New York in which three types of bituminous pavement were put in competition with each other. They were described as nearly as possible to provide such thickness for each kind as would put them on a parity in bidding. I must admit that in this case, where a contract was let for a pavement which the municipal authorities wanted to try, it was prevented by the courts from carrying it out; and yet even in view of that experience, even in view of my earnest desire to see the material best adapted to any particular conditions used, I should certainly not vote for the resolution which has been presented, especially in view of the recommendation of the Committee on Resodlutions, which I think has given fair and impartial consideration to the matter.

PRESIDENT DEAN: Anything further?

MR. TILLSON: Mr. Chairman, possibly I might help out a little if I gave my ideas as a member of the committee in voting for this report. I appreciate fully the remarks that Mr. Warren made, and I feel that any man who has patented any article, no matter whether it is a pavement or what it is, is entitled to receive some credit and something more substantial than credit for his work, no matter whether it is a pavement, or whether it is a machine or a piece of a machine. But in this particular case, here is a law that has been in existence only eight months, and there has been no time to see how it will operate. Some of the state officials are afraid that it will militate against them, think that it is in contradiction to their laws, but I felt as a member of the committee—and I think others felt the same way—that we would be a little hasty at this time in taking any such action as asking for that rule to be rescinded. If, however—and I said this in the committee meeting—at the end of another year, after this regulation has been tried out and it has been found to work against states in their practice and use in laying pavements, then it will be another matter, and then I do think it would be highly proper for this association to discuss very seriously the propriety of taking some such action as this. It was for that reason and not that I was opposed to the general proposition or opposed to patented articles that I voted as I did in the committee.

J. A. JOHNSTON (Division Engineer, Massachusetts Highway Commission): I don't think I quite understood that. Do I understand that that absolutely prohibits the use of patented articles?

MR. TILLSON: No.

MR. JOHNSTON: But merely, if there are laws in certain states that prohibit the use of patented articles then they cannot be used in connection with government money because the state law prohibits them? Does any state law actually prohibit them?

MR. TILLSON: I don't think so.

MR. JOHNSTON: As I understood Mr. Warren, the law of New York State simply prohibits the use of alternate bids on various types of pavement. Is that right, Mr. Warren?

MR. WARREN: That is correct.

MR. JOHNSTON: But it does not prohibit the use of patented pavement.

MR. WARREN: It is the law of the State of New York, and, as I believe, fully 50% of the other states, taken in conjunction with Regulation 8, Section 4, that makes it prohibitive. The federal aid act says that contracts shall be let; specifications shall be drawn; and contracts shall be let in accordance with the several laws of the states in which the work is to be done.

MR. JOHNSTON: But the state law does not prohibit?

MR. WARREN: The state law does not prohibit. If it stopped there, there would be no prohibition whatever, but this article under consideration says that there shall be no royalty or other remuneration paid for the use of any patented or proprietary article unless that patented article in direct competition with some other patented article is offered at as low or a lower price. Now, I say in the states where the state laws provide that the state must determine the kind of pavement in advance of receiving bids that it is absolutely impossible to comply with the state law and comply with this regulation. Furthermore, it is, generally speaking, practically impossible for a patented article to offer itself at as low a price as some other unpatented article.

MR. JOHNSTON: But the patented article can be offered in competition providing everybody pays the same royalty. Is that right?

MR. WARREN: The regulation is, there shall be no royalty paid, no part of the government money shall be used for that purpose.

PAUL D. SARGENT (Chief Engineer, Maine State Highway Commission): A thought that has occurred to me in connection with laying patented pavements on federal aid roads is that if the royalty for the patent could be definitely established it might be possible for the state to agree to pay the amount of the royalty and the federal government then allow its proportional part of the balance of the cost of the work on any project where the local officials desire to lay a patented pavement. I suggest that you gentlemen who are interested in patented pavements, or think that you would like to lay them, consider this point carefully.

With respect to the adoption of the resolution, I feel just as Mr. Tillson does: that until it has been definitely established that the Secretary of Agriculture will absolutely prohibit the laying of patented pavements or the use of any patented or proprietary article in connection with the construction of federal aided roads it would be unwise and decidedly inexpedient and discourteous for this association to attempt to dictate to the Secretary of Agriculture what we think he ought to do.

PRESIDENT DEAN: In order that there may be no misunderstanding I will again read the report of the committee. You have heard the resolution read. The committee reports, to you as follows: "Your committee gave the resolution offered by Mr. L. D. Smoot, of Florida, careful consideration, and recommends that it be not adopted." The question before the house is upon the acceptance of the report and the adoption of the recommendation contained therein.

MR. WARREN: Mr. President, in due deference to the committee I move that this report be adopted.

MR. SARGENT: I second the motion.

PRESIDENT DEAN: It is moved and seconded that the recommendation of the committee be adopted. As many as favor it say "Aye," opposed "No." It is a vote, and the report of the committee is accepted and its recommendation is adopted.

MEETINGS

Calendar of Coming Meetings

February 19-24.—Southwestern Concrete Association—Annual meeting and show, Kansas City, Mo. Chairman of committee, Charles A. Stevenson, 1433 West 10th St., Kansas City, Mo.

Feb. 20-21.—Connecticut Society of Civil Engineers—Annual meeting, Mason Laboratory, New Haven, Conn. Secretary, J. F. Jackson, New Haven, Conn.

February 21-23.—Iowa Engineering Society—Annual meeting, Ames, Ia. Secretary, J. H. Dunlap, Iowa City, Ia.

March 5-6—National Paving Brick Manufacturers' Association—Annual convention, Hotel McAlpin, New York, N. Y. Secretary, Will P. Blair, Cleveland, Ohio.

March 5-7—American Ceramic Society—Annual meeting, Hotel Astor, New York, N. Y. Secretary, Edward Orton, Columbus, O.

April 17-20.—U. S. Good Roads Association.—Fifth annual convention, Birmingham, Ala. Secretary, J. A. Rountree, 1021 Brown Marx Building, Birmingham, Ala

Tenth Chicago Cement Show

The Tenth Chicago Cement Show was held in the Coliseum and Annex, Chicago, Ill., Feb. 7-15, under the management of the Cement Products Exhibition Co.

The road exhibits consisted of concrete paving mixers, motor trucks with dumping bodies, pressure oil and asphalt distributors, concrete culvert forms, concrete drain tile, scrapers, road drags, car unloaders, excavators, industrial and dump cars, joint protectors and fillers, bottom dump wagons, tractors and trailers, finishing machines for concrete road construction, joint protection plates, sand and stone screens, aggregates, road surfacing asphalts, reinforcement for concrete roads, and the joint exhibit of about twenty of the leading Portland cement manufacturers.

American Concrete Institute

The three-day session of the American Concrete Institute, constituting the thirteenth annual meeting of the organization, was held at the La Salle Hotel, Chicago, Ill., Feb. 8-10, inclusive. The registration was over three hundred, and while not so large as it has been in some years, was representative. More than one-third of the entire program was devoted to roads, bridges and culverts. A brief summary of the proceedings of the meetings follows:

President Leonard C. Wasson called the meeting to order for the first session and made a few brief remarks welcoming the members present. The regular program began at once with the reading of a paper on "Slag and Cinders as Aggregates," by Sanford E. Thompson, Consulting Engineer, of Boston, Mass. In describing some interesting tests which he had made it was shown that in the 28-day test slag concrete showed a strength 50% higher than concrete in which gravel was used as the coarse aggregate, and at the same time was approximately 15% lighter in weight. Mr. Thompson stated that there were no authentic cases known of deterioration of slag concrete, and that close observation has shown that it provides a strong bond, protects steel reinforcing and has satisfactory weathering qualities.

The next paper of interest to road authorities was read by C. A. Crane, Secretary of the General Contractors' Association, New York, N. Y., and was entitled "Relations Between Engineers and Contractors." It contained some sound advice for both engineers and contractors.

The report of the Committee on Reinforced Concrete, of which committee E. J. Moore, of New York City, is chairman, was presented at the evening session. This report, which differs materially in a number of important features from the joint report of the various committees representing the engineering societies of the country presented at the recent meeting of the American Society of Civil Engineers, provoked considerable discussion, but was accepted by the members present, who ordered it to a letter ballot of the entire membership of the institute.

The Friday evening session was devoted exclusively to concrete highways and was the best attended session of the meeting. The concrete road and pavement specifications of the institute were amended in a number of cases, though some of the changes were of minor importance and in form only. Two important changes were the raising of the size of coarse aggregate from 1 and 1½ in. to 2 in., and providing that fine aggregate showing more than 7% loam or clay content in the field test should be rejected without waiting for the laboratory test. In reference to important changes that are being made in methods of finishing, the report of this committee, of which A. N. Johnson, of Chicago, is chairman, states that it was thought best to specify the results to be secured rather than the means to be employed, defining its attitude as follows:

"The concrete shall be brought to a proper contour by any means which will insure a compact, dense surface. Any holes left by removing any material or device used in constructing joints shall be filled immediately with concrete from the latest batch deposited.

"Concrete shall be finished in a manner thoroughly to compact it and produce a surface free from depressions or inequalities of any kind."

A. T. Goldbeck, Engineer of Tests of the Office of Public Roads and Rural Engineering, Washington, D. C., was unable to be present, but his paper on "Friction of Concrete Slabs on Different Supporting Materials" was read by Secretary Hynds of the institute. The paper gave data on results of experiments in which concrete slabs have been laid on a variety of sub-bases and sub-base materials.

Wm. M. Acheson, Division Engineer of the New York State Commission of Highways, read an interesting paper on "Essentials for the Successful Construction of Concrete Highways," in which the practices and methods employed in New York State were described, together with the results that had been obtained.

"The Condition of Wayne County Roads" was described in a paper prepared by A. N. Johnson, Consulting Engineer of the Portland Cement Association. Following the reading of the paper, Edward N. Hines, under whose supervision the concrete roads of that county were built, described in considerable detail the methods employed last year and the results accomplished.

Austin B. Fletcher, State Highway Engineer of California, was not present, and the members were greatly disappointed at not being able to hear his paper on "Experience in the Construction and Maintenance of Concrete Highways in California."

The cost of road maintenance, as set forth in a paper on "The Maintenance of Concrete Roads in Connecticut" by

W. Leroy Ulrich, of the Connecticut State Highway Department, was of particular interest.

The final paper of the evening was "Some Recent Developments in the Construction of Concrete Roads," by William M. Kinney, of the Universal Portland Cement Co., Chicago.

At the closing session of the institute a number of reports were submitted as follows: Report of Committee on Reinforced Concrete Highway Bridges and Culverts, report of Committee on Concrete Aggregates, and report of Committee on Concrete Sidewalks and Floors. A paper on "Lessons from Culvert and Bridge Failures," by Thomas H. MacDonald, State Highway Engineer of Iowa, was also scheduled for this session.

The Bankhead National Highway Association will meet in Birmingham, Ala., on April 19, 1917. Its officers are: President, Col. T. S. Plowman; Secretary, J. A. Rountree, 1021 Brown Marx Building, Birmingham, Ala.

At the annual meeting of the Ohio Engineering Society in Columbus, Jan. 29 to Feb. 2, officers were elected as follows: President, A. R. Taylor, Findlay; Vice President, T. J. Smull, Ada; Secretary-Treasurer, John Laylin, Norwalk, Ohio.

A meeting of the Board of Directors of the National Paving Brick Manufacturers' Association will be held at the Hotel McAlpin, New York, N. Y., on March 5 and 6. The Secretary of the Association is Will P. Blair, 830 B. of L. E. Building, Cleveland, O.

PERSONAL NOTES

Duncan Buie has been appointed State Highway Engineer of Louisiana. He succeeds W. E. Atkinson.

C. L. Dimmit has been appointed City Engineer of Redwood City, Cal., succeeding A. M. Porter, resigned.

H. P. Hayes has been reappointed County Engineer of Tarrant County, Texas, for a term of two years at a salary of $2,400 a year. His headquarters are at Fort Worth.

N. S. Thayer, formerly Assistant District Engineer of Martin and Murray Counties, Minnesota, has been made District Highway Engineer of the State Highway Commission, with headquarters at Worthington, Minn. He also has supervision of road work in Nobles County, taking the place of D. E. Davidson who now has charge of Rock County road matters.

Dr. W. F. M. Goss, Dean of the College of Engineering, University of Illinois, has resigned that office, effective March 1, 1917, to assume the presidency of the Railway Car Manufacturers' Association, to which he was elected on Feb. 1, subject to his release by the University authorities. For many years he was associated with the School of Engineering of Purdue University.

PUBLICATIONS

WISCONSIN HIGHWAY COMMISSION. Third Biennial Report, Jan. 1, 1914, to Jan. 1, 1916, with Preliminary Estimates to Dec. 1, 1916. Cloth, 6x9 ins., 329 pp. and covers; illustrated.

The major portion of this report is taken up by detailed data on highway work during the period covered in each of the several counties of the state. There are also included several chapters dealing with the general features of highway work in the state, and with special phases such as maintenance, traffic and its control, the federal aid law as applied to Wisconsin, grade crossings and the like. Twenty-three tables showing various details of state and local work are also included. The illustrations consist of halftones, most of which show road work under way or roads before and after improvement. Several views of improved bridges are also shown.

THE EFFECTS OF EXPOSURE ON TAR PRODUCTS. By Charles S. Reeve, Chemist, and Benjamin A. Anderton, Assistant Chemist, Office of Public Roads and Rural Engineering, U. S. Department of Agriculture. Reprinted from the Journal of the Franklin Institute, October, 1916. Paper, 6¾x9½ ins., 16 pp. and covers; illustrated.

Included in this report are the results of experiments made on samples of tars of various kinds to determine the effect upon them of exposure to sun and air. Several tables showing the analyses of the samples and the results of the tests are included, as are also illustrations showing the apparatus used.

NEWS NOTES

A Reinforced Concrete Bridge in Twenty-Seventh Street, Kansas City, Missouri, extending from the Paseo to Highland Ave., is to be constructed at a cost of $75,000, according to a recent report.

The Stone Avenue Bridge in Seattle, Washington, is the subject of controversy between the United States Engineer Corps and a special committee appointed by the City Council. In accordance with an agreement with the city, the Stone Avenue bridge was to be removed upon the completion of the new Fremont Avenue bridge. Its retention has been urged by residents of the north end, who claim that growth of traffic warrants the use of two bridges. Lieut. J. B. Cavanaugh, Chief of the Northwest Division, stated that the Stone Avenue bridge could not be permitted to remain for the reason that it does not meet the government's requirements as to piers, height and span, and that it would require an act of Congress to build a new structure in its place.

The Use of State Convicts for Road Building is increasing according to statistics just published by the Office of Public Roads and Rural Engineering of the U. S. Department of Agriculture. Studies made by the department in cooperation with public officials show the systems adopted by the several states in the operation of convict camps and conduct of road work. The most satisfactory use of the system under which the labor of convicts is devoted to public structures and roads, in the opinions of the department's road specialists, is under state rather than county administration. Since 1885, the report shows, the percentage of convicts engaged in road work alone has increased from 1.3 per cent. to nearly 13 per cent. It is pointed out that only those who are physically fit should be employed on the roads, and it has been found that ordinarily from 25 to 50 per cent. of male convicts are available for the work.

Highway Projects in Southern New Mexico, including those adjacent to Silver City, have been under investigation by the State Highway Engineer. The Silver City-Tyrone road has been improved for a distance of 12 mi. at a cost of $30,000. The County Commissioners of Grant County have made arrangements to turn over to the State Highway Department $6,600 now in the Mogollon road fund, together with the proceeds of this year's levy amounting to $8,000, which with $10,000 left in the Silver City-Tyrone fund, will be expended on the scenic highway between Silver City and Cliff on the Mogollon Road. Of the proposed Lincoln County road bond issue $4,000 will be spent on the road from Corona to Carrizozo; $1,000, White Oaks to Carrizozo and Jicarilla; $3,000, Lincoln to Arabella; $1,500 in Devil's Canyon; $3,500 on the Alto-Nogal road, and $500 on the Angus-Capitan road, while the remainder of the bond issue of $55,000 will be spent on other highways.

GOOD ROADS

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Papers Presented at the Fourteenth Annual Convention of the American Road Builders' Association—III.

NOTE: The three papers printed here complete the list of those presented at the convention. The other six were printed in the issues of Feb. 10 *and* 17.

Recent Practice in Wood Block Pavements

By ELLIS R. DUTTON,
Assistant City Engineer, Minneapolis, Minnesota

Pavements are almost as old as people. When people began to be civilized and neighborly, then began the need of a better means of communication, and, as needs increased, methods were put in force to alleviate those needs, and invention, you might say, was called upon. The rough trail was smoothed and the wet places were filled and bridged so that a better means of communication was provided. As time went on, and the methods of transportation were improved, a better road was required and a surface that would permit of communication in all kinds of weather. This was provided by the use of broken stone of larger dimension and of greater depth. The remains of the old Roman roads are seen today and show how well they were built, but these roads would not only be costly in these days, but they would be useless under the modern methods of transportation. Stone, however, of some form has been used in the construction of pavements from time immemorial and probably will continue to be used indefinitely in some part of the work.

The use of wood as a paving material did not begin until in recent years, and then it was not successful on account of its rapid deterioration. It was used in London and New York in the early 30's of the 19th century, and somewhat later on the continent. These pavements were rough, or soon became so, and the improvements were along the lines of a smoother pavement, which resulted in the so-called "Nicholson" pavements laid quite extensively about 40 or 50 years ago. This pavement fulfilled the desired smoothness, but did not last, as the wood was untreated and permitted water to enter and the blocks soon decayed. There was also tried in this country, and particularly in the west, the round cedar blocks. The triangular interstices between the round blocks soon permitted travel to also round the top of the block, making the surface very uneven and rough and reminding one of the old corduroy roads. Decay also played havoc with the blocks, and in a very short time this pavement had gone the way of its predecessors and some other class of pavement had to be used.

About this time attention was turned to some examples of wood which had been treated with dead oil of coal tar and used for paving purposes. One example was in Galveston, Texas, where some creosoted pine blocks were laid in 1873. Another was in New Orleans where similar blocks were used; also in St. Louis in 1877. The extended use, however, of this class of pavement did not begin until about the beginning of the 20th century; and then its advocates had to overcome the prejudices that had arisen on account of the previous use of untreated wood. It was, however, recognized that if wood could be preserved from decay, it would make a better pavement in many ways, than any other kind of material.

One of the earliest pavements of this material, in the Middle West, was laid in Minneapolis in 1902, which has made a record as to durability and low cost of maintenance and from present appearances it will be good for a number of years. There are numerous examples throughout the country, of as good, if not better record; one right here in the City of Boston, laid, I think, a year or two prior to that in Minneapolis. Last year I had the pleasure of inspecting with Mr. Geo. W. Tillson (the engineer who laid them) some creosoted wood block pavements in the City of Brooklyn. These were laid in 1903 and 1904, and they were in excellent condition. From these beginnings the industry has come to the present time through many experiments, changes and improvements, to the present day practice. Some things that were considered in the early days of the industry of little importance have proven to be of vital import; and other things formerly considered "the thing" have been relegated to the "discard."

One of my first experiences along these lines was, when in the treatment of some blocks in 1903, the sap wood showed a penetration of the preservative of only ½ in. or so. I did not think that it was sufficient, but the expert said the oil would penetrate further as the block aged, and that he would guarantee it to be preserved. Well, the results show that the oil was insufficient; that it did not penetrate any further; that the blocks were not preserved, and that the expert's guarantee and the blocks were rotten. So we had to learn something ourselves and not depend on the so-called expert opinion of interested persons. Since investigating, studying and applying knowledge gained, we have had no such results, and we have learned that the oil has to be put into the wood if you wish to preserve it.

Another fallacy of the early days was the idea that you had to extract all the resins, etc., from the wood before treatment; and certain methods of steaming were resorted to, to accomplish this result. The fact of the matter is, no such results, as intended, were accomplished, but inadvertently a result was accomplished which in later days is considered quite necessary; that is, the expansion and drying or seasoning of the blocks by steaming. This feature, the proper preparation of the blocks before the introduction of the oil, and the proper treatment of the blocks after the introduction of the oil, is now considered a matter of prime importance, and the quality of the oil is more of a secondary matter.

For a number of years the oil was the whole thing and there was a great diversity of opinion as to the best oil to be used; whether it was a heavy oil, or a light oil, or a tar oil, or a distillate oil; whether it was a coal-gas tar oil or a water-gas tar oil. It has been found that there is quite a number of oils or tars that are suitable to be used, and any one of them will preserve the wood and make a first-class paving block. The statement has been made that oils used in about 1908, when the gravity of the oil was raised from 1.08 to 1.10, would not be stable and remain in the blocks and would not preserve them. We took from the street, in the fall of 1916, some of the blocks treated in that year, 1908. and extracted the oil to see what changes had occurred in the oil. From a comparison with the original oil, it showed that the residue originally above 355°, was 49%; in the extracted oil it was 52%. The gravity of the original oil was 1.10, and of the extracted oil 1.116. The amount of oil per cubic foot in the original treatment was 16 lb.; and from the sample from which the oil was extracted it was about 12 lb., showing that there had probably been some loss, but that there was plenty of oil remaining to insure its preservation for a number of years. There was no indication of any decay or anything of that kind noticeable in the pavement, so that the theory that the oil had evaporated or did not preserve the wood was false.

Almost all of the engineers and wood preserving experts agree in recommending a heavy oil of a gravity of 1.08 to 1.12, and the majority recommend a coal tar oil, though they do not discourage the use of a distillate oil except as to the cost and use of a less amount of oil than 16 lb. per cu. ft.

A committee of the American Wood-Preservers' Association has been investigating the claim of the water gas tar producers as to the preserving properties of their material. They cited numbers of places where wood paving blocks treated with water gas tar had been used successfully. From the personal investigation of the committee as shown in the report as presented to the meeting of the association held in New York in January, 1917, it would appear that "Refined water gas tar has demonstrated its value and usefulness as a preservative for wood paving block" (p. 47, advance copy of Report of Committee on Preservatives).

There has been, however, considerable progress made as to the method of treatment which has done more toward making a better block, than along the oil lines. Under the old methods difficulties and objections arose after the pavement was laid, on account of swelling, bleeding, etc. These objections were directly traceable to the method of impregnation. Experiments and tests were made to improve the process, and the improved method now advocated provides that the blocks be steamed from 2 to 4 hours before the vacuum is applied. This vacuum should be at least 22 in. and held for at least 1 hour. The preservative oil is then run in without air being admitted, and pressure gradually applied until the required quantity has been forced into the blocks. After this, a supplemental vacuum of at least 20 in. shall be applied for not less than 30 minutes. If necessary, the vacuum may be preceded or followed by a short steaming process.

This is the specification as adopted by the various societies having to do with such matters. This treatment produces a block in which the oil has thoroughly penetrated the sap wood and the interior of the block, and leaves the outside clean and dry so that there is almost no bleeding.

We laid a section of paving blocks treated as above, in 1915, in which a part was filled with the ordinary pitch filler and a part was filled with sand, to determine actually whether blocks so treated did bleed. We found that the part filled with sand showed almost no bleeding, only a block here and there showing oil on the surface, while the bituminous filler used on the other part caused almost all of the so-called bleeding. There have been some misstatements made as to this experiment, and attributing the bleeding to the use of a coal tar pitch filler. Such is not the case; as any bituminous filler either pitch or asphalt would cause the same result. If some material could be provided which would eliminate this feature and still preserve the good qualities of the bituminous filler, it would be a great benefit to the wood block industry, and incidentally, to the person introducing it.

Creosoted wood block paving, in this country at least, has been usually laid on a sand cushion of approximately 1 in. in thickness spread on the top of the concrete foundation. There has been a large amount of successful pavement laid in this manner, but there has been also quite another large amount that has not been so successful. If the right quality of sand be used properly, it is all right, but under most systems of doing work, it would be better to use some other method. Probably the best practice to be followed is to make a smooth surface, true to grade and contour, on the concrete foundation, when it is laid. Immediately before the laying of the blocks, this surface is painted with a thin coating of bituminous material of the proper consistency. The blocks are then laid on this bituminous coating, to which they adhere, and the joints are filled with the usual material. This differs from the European and Continental practice, where the concrete is made smooth, but the blocks are dipped in the bitumen and then laid on the concrete. I examined an interesting example of a pavement laid in the first method outlined above, on Dawson Road, a highway leading out from the City of St. Boniface, near Winnipeg, Canada. This work was done in 1910, using a Norway pine block 3 in. in depth and treated with 16 lb. of heavy oil. There were several brick yards that used the pavement in hauling their products to town, and also the country travel in and out. The street had no care or maintenance, and no sprinkling had been done to keep the blocks from drying. At the time of the investigation in 1916, the pavement was in good condition and showed no evidence of bleeding or swelling, the curb along the edges being true and straight as they were when placed.

In the earlier days of the industry it was considered necessary to provide expansion joints at right angles to the curb line, and to lay the blocks at right angles. These expansion joints were found to be a source of weakness to the pavement and also to be of no use, so they have been discontinued. It is still an open question as to whether the blocks should be laid at right angles to the curb or on some other angle. In the experimental pavement laid in Minneapolis in 1906, there were three contiguous sections laid; one at 90, one at 67½ and one at 45 deg. From the several inspections of these sections it is quite apparent that the blocks laid at 67½ and 45 deg. show less trouble from joint wear than those at 90 deg. These blocks were Norway pine and would show the wear much faster than a harder pine.

There has been considerable discussion as to the effect the steaming required in the new specifications, as above outlined, would have on the crushing strength of the blocks. Experiments have been made by the Forest Service, and a paper by Mr. Clyde H. Teesdale, giving the results of such tests was presented to the American Wood-Preservers' Association at its recent meeting in New York. From these experiments, there does not appear to be any weakening of the crushing strength of the blocks by such treatment. Treated green heart pieces gave average results 3.5% below the corresponding natural pieces; treated green sap pieces, about 1% higher than corresponding natural pieces; treated air dry heart pieces 10% higher than natural pieces; and treated air dry sap pieces 8.5% higher than natural pieces.

The value and usefulness of a pavement depends largely on the cost of its upkeep, and a pavement where the repairs are low is the better, all things being equal. There have been numerous inquiries as to the cost of repairs on a creosoted wood block pavement. The following is the cost in cents per square yard per year for repairs, to creosoted wood block pavements in Minneapolis for the various years, and also shows the total yardage in place on Jan. 1 of each year:

Year.	Total Square Yards.	Maintenance per sq. yd.
1907	210,464	$0.012
1908	312,815	0.085
1909	457,583	0.052
1910	600,922	0.064
1911	757,472	0.294
1912	928,726	0.162
1913	1,060,688	0.193
1914	1,195,932	0.254
1915	1,381,605	0.239
1916	1,516,819	0.054

The average cost of repairs in the 10th St. paving laid in 1902, for the past 10 years has been about 0.1 ct. per sq. yd. per year. From these figures you can readily see that the maintenance or upkeep cost is very low and that this class of pavement fulfills the requirements of a first-class pavement as to cost of maintenance; and there is no question as to its exceeding all others as to its noiselessness and tractive resistance.

There has been in times past a great deal of controversy over various things to do with the materials and manufacture of creosoted wood blocks. It is very gratifying indeed to see these things being overcome, and a better feeling of unity prevailing as to the disputed points by all parties, so that now they can agree on a uniform standard specification.

This adoption of a standard specification does not mean that we have learned all there is to know about creosote or wood block pavements. There is just as large a field for investigation, experiments and improvements, as ever, and we should be all the better prepared, by reason of the accumulated knowledge, to go forward and make and maintain wood blocks as the best pavement known.

The Excavation, Manipulation and Transportation of Materials

By JOHN H. GORDON

Albany, New York

The contractor's plant and equipment represent a most considerable outlay and his largest fixed investment, and upon the discriminating purchase, intelligent operation, and adequate care of this factor of his business depends in a great measure his success. Owing to the nature of the work of road building, scattered, as nearly every contract is, over five or perhaps ten miles of country, it is difficult for the individual contractor to give that concentrated attention to every part of his work which it is necessary to give in order to arrive at the true value of the various large tools, their proper use, and their proper manipulation. Many contractors, even men of experience and ability, will continue for season after season with tools and methods which could be improved upon and would be if proper attention were to be given. Occasionally we find a man thoroughly posted on every detail of the work, but not often; it is a wide field, and usually we find men posted better on one part than on another. And if the contractors present will enter into a frank discussion of their views and their experience in the use of the various tools it will be of immeasurable value.

The ultimate success of the contractor of ability, industry and experience, and whose work is properly financed, depends on two principal factors: first, his organization and second, his plant and equipment. I have placed his organization as the more important of the two, for it will be conceded that with an efficient organization results may be obtained even though the plant and equipment are not of the best. And it is equally true that a thoroughly up-to-date equipment improperly handled, run by incompetent men, will fail to produce the expected and possible results.

There are steam shovel engineers who will get out twice as much material in a given time as their less skilled confreres. There are auto truck drivers who will get more mileage, carry heavier loads and preserve the integrity of their machine immeasurably better than the less competent chauffeur whose experience has been brief and often only with a light pleasure car. There are good steam roller engineers, and good ones are very rare, whose work will be a great factor in the final result of building a good road—men who know when the subgrade is properly and sufficiently rolled, when the stone is properly rolled, how to roll and treat the different varieties of stone, and this is an important matter, and who are in fact real road builders. Too often the contractor trusts this expensive machine, and relies for results, perhaps the most important in his entire construction, upon the judgment of a man whose experience has been gained in running a saw mill, or threshing machine, or traction engine, and whose only knowledge is in being able to keep up steam and make his machine run back and forth.

I may seem to digress but I want to make plain that the success of the equipment, however perfect it may be, must depend largely on the men who handle it.

Small Tools

The small tools, picks, shovels, grubs, plows, etc., are not usually considered as plant but as a part of the costs of the job for which they are bought. And yet a brief word about them: Plows whether rooter or grader should be of the best, as they are the most economical. The points will have to be replaced, but the plow itself should last several seasons.

In the purchase of shovels I do not think the costly shovel is best, i. e., the shovel costing from $10 to $12 a doz. The shovel that costs $7.50 a doz. will be found to answer as well, and the percentage of lost tools on road work is also a consideration. The same is true of grubs and mattocks.

Of picks I recommend the best, which will insure a saving in blacksmiths' bills. From time to time we are offered special steel for tipping picks and drills; it may be all it is represented, but whether or not the fault is due to the country blacksmiths' lack of knowledge of tempering or some other cause, I have found this special steel of little avail.

Large Plant

The contractors' plant and equipment proper consists of the large and expensive tools which are carried on his books as an asset of his business—always a considerable asset, and too often the only asset. Conservative management should mark off yearly a material depreciation, but in the lean years this is sometimes omitted, and the contractor deludes himself into thinking that his resources are much greater than their actual market value even when favorably sold.

The steam roller in general use is the 10-ton double-cylinder roller, although there are some makes of single-cylinder rollers that are good. There are also some heavier rollers, 12- and 15-ton, which have their special use, but the 10-ton roller for all purposes has been found, after many years' experience, generally satisfactory and as heavy as is needed. Where there is sufficient work to warrant and the contractor can afford the equipment, the 8-ton tandem roller for finishing bituminous roads is an excellent tool. The double-cylinder roller is coming more and more into use for hauling, a purpose for which the single-cylinder roller is not so adaptable. Many contractors hesitate to use their rollers for hauling, and yet where conditions permit, where the road is not too hilly, water available, etc., it is one of the very cheapest methods of hauling. The life of a roller is indefinite; with care it will surely last ten years and more. An oil pump for the cylinders will repay its cost many times over. A roller should be cleaned out often, at least every two weeks, and this is true of all steam boilers on the work. And the use of a compound suitable for the water of the locality is to be recommended. These details are frequently overlooked, but are valuable helps in continuing the efficiency of the tools and prolonging their life.

The use of steam shovels on state road work has been made possible in the past few years by the construction of a shovel of smaller size. Unquestionably there is a material saving in the initial cost of steam shovel excavation over any other method, but much consideration should be given to the purchase. A firm with ample capital and doing a large business will find it an excellent tool, but the smaller contractor building one or two roads a year should make haste slowly owing to the number of roads of light excavation. An idle tool depreciates almost as rapidly as a busy one, and the size of the investment makes the interest item and depreciation in market value factors of importance. There is also to be considered the greatly added wear and tear on the wagons used in loading from the shovel.

The stone crushers in general use are the jaw crushers, and the size favored is the one with the jaw opening of 10x20 in. or 12x20 in., which is the largest size that is portable. There are some jaw crushers in use of a considerably larger jaw opening. These are mounted on skids and are well adapted for use where a considerable quantity of stone is to be crushed at one location.

The gyratory crusher as at present constructed is only suitable for a stationary plant.

The size of the boiler and engine to be used is important; a 30-35 is to be recommended, although many smaller are in use. The 50-ton portable bins may be used to advantage where the output is to be approximately 3,000 cu. yd. For a larger output the 100-ton stationary bin will more than repay the additional cost, by providing storage capacity and facilitating the progress of the work. The capacity of the 10x20 or 12x20-in. crushers is about 125 tons in 10 hours, but the difference in the operator will make a variation of as much as 20%. The nature of the stone to be crushed is also a material factor. The number of revolutions the crusher fully runs should never be less than 280 to 290, as reducing this speed diminishes the output. A speed indicator for end of shaft can be bought for $1.00. The use of one jaw of manganese steel will prove a saving.

Much thought and care should be given to the selection of the site for the crusher and to its erection. The crusher itself should be set on concrete so as to reduce the vibration as much as possible. It should be placed as near the quarry or source of supply as is safe, and the approaches should be graded so as to make easy the hauling to the platform of the largest load. The constant lubrication of all parts of the crusher, screen, elevator, etc., is an absolute necessity. The bin for tailings should be placed on the end and at right angles to the supply bins so as to have as little interference as possible with the teams or trucks in loading. These details are often overlooked and the additional cost where neglected may run into thousands of dollars even on one road.

Transportation

In the matter of hauling stone, asphalt, etc., a well known contractor once said that where this work could not be done economically with teams he preferred to let some other fellow build the road. And it is in part true that other methods of hauling have not reached entire efficiency. Most contractors are using one or more motor trucks, with or without trailers. On long hauls over improved roads their value is unquestioned, and for repair work and resurfacing they are economical. On new construction their value is debatable, and the sensitive mechanism over new grading, sub-base, etc., is too often put out of order. Where one truck only is possible the 3 or 3½-ton is usually more adaptable than the heavier, and can be used for more purposes. It should be equipped with hydraulic hoists.

The traction engine and train is not in as general use as it was some years ago, but under certain conditions is still desirable. Where the quarry or source of supply is a considerable distance from the road, and the connecting roads are unimproved, it is usually economical.

The steam roller with train, with not too large a load, provides one of the best and cheapest forms of hauling, and unlike the traction engine, its use benefits the construction. The type of wagon in general use is the 2-yd. dump wagon, of which there are many makes. These wagons when used for hauling in trains should be equipped with short poles and rods, easily removable when wagons are again used with teams. Many contractors are using the heavier 4- and 5-yd. wagons with tractors for special use. The narrow gauge track and cars are used with success where the grade is slight.

There is a tendency among hired team drivers to remove the top box at the slightest provocation, reducing the load carried 25%. A little firmness upon the part of the contractor, when in his judgment the larger load is possible, will affect the result of his work over an entire season.

Teams

Some contractors own their own teams. This is rarely profitable, for if costs be carefully kept one season with another, it will be found that on road work there is little if any saving, and the added investment in a hazardous property is a cause of anxiety and often serious loss.

Grading

The tools used in grading other than the steam shovel are the drag scraper, the 2-wheeled horse-drawn scraper and the 4-wheeled power-drawn scraper, and the Fresno. All these tools have their special use depending on the nature of the excavation, the length of haul, etc., and contractors of experience are thoroughly familiar with the special application of each.

The use of the Fresno is not so well understood in the East, but in the hands of an experienced man and with teams broken into the work it is adaptable to much of the work of fine grading now usually done with pick and shovel, and at a great saving in cost. Contractors in the west are more experienced in the use of this tool; in the west grading contracts are done profitably at one-half of our cost. The nature of the earth handled is an important cause, but undoubtedly we have much to learn in this respect.

The road machine is used by most county and village road superintendents, and yet few contractors avail themselves of this tool and it is difficult to find a grade foreman who has other use for it than trimming shoulders. During the past season on a road of light excavation cost was materially reduced by using one of these machines, of the heavier type, drawn by roller, and guided by a man who had handled one for years on county road work.

Quarrying

The jackhammer drill is coming into very general use on our work. This tool may be used with steam, but is much more efficient when used with compressed air. It is available for drilling holes up to 8 or 10 ft. deep. For longer holes the tripod drill is still the best. The churn or well drill is rather for larger work than we usually encounter. In the use of the tripod drill the custom generally is to pipe to the crusher boiler for steam, but a small boiler just for the drill steam is better. Batteries should always be used for blasting.

Materials from Cars

Where the contract calls for imported stone and in any considerable quantity one of the several unloading devices on the market will prove a saving. It is possible at times to dig a pit under the track, but this often has its drawbacks and in frequent change of location is troublesome and costly. A contractor with an extra or an idle set of stone bins with elevator from his crusher has only to purchase a small gasoline engine to be properly equipped.

In unloading asphalt, and where no trestle is available, a power pump will prove a great saving. In heating asphalt in tank cars the boiler capacity should not be less than 20 hp. to produce the best results. A smaller boiler used with a super-heater may answer the same purpose.

The latest state requirements necessitate the use of a power distributor for applying the asphalt. It is cheaper and better than the hand pouring even though the latter were allowed.

Small Culverts

In the building of state road culverts, or indeed of any small concrete work, the small portable mixers will affect a great saving in labor, and yet many contractors today mix the concrete for culverts by hand.

Brick and Concrete Road Tools

There are two principal styles of concrete mixers in use for this work—the boom and the spout—but the difference in cost of one or the other, or general results obtained, is rather a personal equation; there is really little choice between them, provided, however, that the mix is of that creamy consistency recommended by the engineers' society. For curb and gutter and edging the steel forms will afford a material saving. Like all other tools, however, they must be properly cared for or they will warp and bend. The 5-ton tandem roller for brick is usually used and is best, but good work may be done with a horse roller. The concrete wheelbarrows should always be used, as they will pay for themselves in a short time over the ordinary grading barrow. A contractor on this kind of work should be provided with several large pieces of canvas to protect his cement on the work. Where the water has to be brought from some distance the use of a gasoline pump and piping is an economy.

Housing the Men

Not enough attention is paid to the matter of the men's quarters. They should be located somewhere near water when possible, and in a healthy and pleasant place. The steel frame bunks with wire springs should be used. One man should be detailed to keep the building clean.

Instead of building a camp many times an idle house or a barn may be available which can be fixed up to make more desirable quarters and usually at a considerable saving in cost.

The reasonable limit to which I should confine my paper precludes more than this brief mention of the many tools and their uses on our work. I appreciate that many opinions here expressed may be disputed, but they are as given from my own experience, observation and discussion with other contractors engaged in road building.

It will be understood that I am speaking strictly of state road work and that some opinions here rendered would be subject to modification or change if I were treating other kinds of work.

Recent Practice in Granite Block Pavements

By WILLIAM H. CONNELL,
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The modern granite block pavement is symbolic of the most marked advance made in recent years in a street pavement. The evolution of this pavement from an ugly appearing, noisy, rough-riding, unsanitary one to a smooth surfaced, easily cleaned, sanitary pavement and one better adapted to very heavy traffic streets than any other existing type is a noteworthy example of the possibilities of accomplishment through cooperation of the manufacturer and the highway engineer. This same cooperation has also resulted in outlining a scheme to utilize the old, obsolete rough granite block pavements that were laid on many of our highways years ago. In 1907, Mr. William Booth, of the Booth Brothers and Hurricane Isle Granite Co., which controls a number of granite block quarries, went to the Chief Engineer of the Borough of the Bronx, New York City, and suggested instead of discarding the old rough granite blocks on one of the main thoroughfares in the borough, that he arrange to split these blocks and relay them with grouted joints. This method of construction resulted in a smooth granite block pavement and probably was largely responsible for the development of the modern granite block. Since then, this pavement has been known as the "redressed granite block pavement," and is extensively used in New York, Philadelphia, Albany, Newark and a number of other cities in this country.

There is, of course, a place for every type of modern street pavement, but until the smooth dressed granite block was developed, there was no suitable type of pavement for very heavy traffic streets, where a gritty surface, to give the horses a foothold, was essential. The great advantage of this pavement is that, properly constructed, it is a smooth riding pavement for automobiles and at the same time has a sufficiently gritty surface to give a good foothold for horse-drawn traffic.

In discussing pavements, we must always keep in mind the important fact that there is no type of construction that is ideal for all streets. In each case the selection of the pavement must be based on an engineering study of the peculiar conditions to which it is to be subjected, such as the amount and character of traffic, the social and local conditions as relating to the abutting property, sanitary requirements, and economic considerations, from the standpoint of the annual charges, including the maintenance cost, interest and sinking fund charges on the first cost for the economical life of the pavement.

In addition to this must be considered the all important factor—the convenience of the traveling public and occcupants of abutting property which, in some cases, makes it more desirable to lay a pavement that shows a greater annual cost to the government, but a considerably longer life than another type. The inconvenience to the public and the financial loss to the business interests through the frequent repaving of streets cannot be definitely estimated in dollars and cents, but in considering the selection of a pavement from an economic standpoint we must not only take into consideration the annual cost to the city, but the saving to the business interests through the selection of a suitable type with the longest possible life under the specific traffic conditions, and it is in such cases on very heavy traffic streets that the economy of granite block pavement is unquestioned.

If there were more general promotion of the economic advantages of good roads and pavements and less promotion of specific types of pavements for certain streets where, from an engineering standpoint, they are not as suitable as some other type, there would be a greater yardage of all the standard types of pavements for streets and roads laid every year as they are all peculiarly adapted to certain traffic and other conditions, and give the best service when subjected to such conditions, whereas when laid on streets or roads for which they are not suited, poor service is the result and they receive a "black eye" and hurt not only that specific pavement, but the whole highway propaganda.

Statistics show that horse-drawn traffic is not increasing to any appreciable extent, while the number of automobiles using the highways is doubling about every two years. This being so, there is no reason to suppose that there will not be twice as many motor vehicles in 1919 as there are today. This enormous increase in traffic places a great burden on the highway engineer, and needless to say, people as a rule do not appreciate the magnitude of the problem he has to contend with. As a mater of fact, the ordinary layman is so intent on finding some sort of pavement that is ideal under all conditions and does not require any upkeep, that he does not appreciate the advance that has been made in recent years in improving the different standard types of pavements, such as, for instance, the improved granite block.

When you discuss granite block pavements a great proportion of the population of this country still picture in their minds the old rough granite block which is very noisy and entirely unsuitable for automobile travel. A great deal of this prejudice has been overcome in many cities through an educational campaign carried on by the different highway engineers. It is, however, surprising to know how many people are still unaware of the smooth, gritty surfaced, easy riding granite block pavement. There is some objection on certain streets to even the modern granite block, on account of the slight noise from the steel tired traffic, but this trivial objection will be entirely removed within the next few years, as the steel tired vehicle will very soon be a thing of the past.

Methods of Construction of Granite Block Pavements

In order to obtain the best results in granite block construction, the first step naturally is to determine upon the specification for the block itself. The American Society of Municipal Improvements has adopted the following specifications for a standard block, as being cut by the majority of the quarries in the United States.

> The blocks shall not be less than 3½ in. or more than 4½ in. wide on top, not less than 4¾ in. or more than 5¼ in. in depth, and not less than 8 in. or more than 12 in. long. The blocks shall not show a variation of more than ⅜ in. on the head under a straight-edge. They shall be so cut that they can be laid with joints not exceeding ½ in. in width.

The Borough of Manhattan, New York City, has adopted the following specifications:

> The block shall be not less than 6 in. nor more than 10 in. long; not less than 3½ in. nor more than 4½ in. wide; and not less than 4¾ in. or more than 5¼ in. deep. All blocks shall be of the selected width, with an allowable variation of ¼ in. either way from this width, but within the limits for width of blocks specified. The blocks shall be so cut that the joints between individual blocks when laid shall average not more than ⅜ in. The head of the block shall have no depression greater than ¼ in. from a straight-edge laid in any direction and parallel to the general surface of the block.

The City of Philadelphia has adopted a specification which is a mean between the specification adopted by the American Society of Municipal Improvements and the Borough of Manhattan.

> The blocks shall be approximately rectangular on the top surface and sides, and uniform in thickness. The size of the blocks shall be as follows: Not less than 6 in. nor more than 10 in. in length, and shall average not more than 9 in., not less than 3¼ in. nor more than 4½ in. in width, and not less than 4¾ in. nor more than 5¼ in. in depth. The contractor shall select a definite width for the blocks to be used in each city block within the limits of the contract. All blocks shall be of the selected width, with an allowable variation of ¼ in. either way over this width, but within the limits for width of block as previously specified. They shall be so cut that the joints between the individual blocks when laid shall not exceed ½ in., and shall average not more than ⅜ in. The top surface of the block shall have no depressions greater than ⅜ in. from a straight-edge laid in any direction and parallel to the general surface of the block. Not more than one drill hole shall show on the head of a block, and none on the ends. An average allowance of not over one block, showing drill hole on side, shall be permitted to a square yard of laid blocks. Unless otherwise stated in the proposal, it is understood that this type of block will be used on all contracts for granite block pavements.

Philadelphia has also adopted the following specification, which it is felt will be very advantageous to be used in resurfacing old brick and asphalt block streets, if desired, on the present concrete foundations.

> The blocks shall be approximately rectangular on the top surface and sides, and uniform in thickness. The size of the blocks shall be as follows: Not less than 6 in. nor more than 10 in. in length, averaging not more than 9 in., not less than 3½ in. nor more than 4½ in. in width, and not less than 3 in. nor more than 3½ in. in depth. All blocks shall be of the selected width, with an allowable variation of ¼ in. either way over this width, but within the limits for width of block as previously specified. They shall be so cut that the joints between the individual blocks when laid shall not exceed ½ in., and shall average not more than ⅜ in. The top surface of the block shall have no depressions greater than ⅜ in. from a straight-edge laid in any direction and parallel to the general surface of the block. Not more than one drill hole shall show on the head of a block, and none on the ends. An average allowance of not over one block, showing drill hole on side, shall be permitted to a square yard of laid blocks.

A great many quarries are also cutting blocks of the following dimensions:

> The blocks shall not be less than 4 in. or more than 4½ in. wide on top, not less than 4 in. or more than 4½ in deep, not less than 8 in. or more than 12 in. long, and they shall be so cut that they can be laid with a ½-in joint, and shall not show a variation of more than ⅜ in. on the straight-edge under the head of the block.

If blocks of these various dimensions are called for and the inspection and methods of handling are sufficiently rigid to insure their conforming with the specifications, and great care is taken in the inspection of the construction of the pavement there is no question about obtaining a first-class job.

Great care should be taken in the handling of the blocks to avoid chipping. Arrangement should be made to carefully unload the blocks from the boats or cars and immediately place them in the conveyances to haul them to the site of the work where the same care should be exercised in their unloading and handling. Rear end dump vehicles should be used as drop bottom wagons unnecessarily damage the blocks. In all cases, the rehandling of blocks should be reduced to a minimum.

It probably appears to the ordinary layman as though there is no great necessity for requiring an inspector with any great ability in connection with laying granite block pavements and it is easily seen how one could hold such an opinion, as the blocks are cut at the quarry to conform to the specifications, and it is only necessary to lay the sand bed or cement mortar bed on a concrete foundation of the required thickness and pour the joints with either cement grout or a bituminous filler. This, of course, sounds very simple, but in order to obtain a first-class job, it is absolutely necessary to be more than particular concerning a number of the essential details, without which a first-class pavement is out of the question.

The standard practice today specifies either a 1-in. sand cushion or a 1-in., 1:4 cement-sand cushion, laid dry. A number of the larger cities rather incline to the cement-sand cushion in preference to the ordinary sand cushion as it is felt that weaknesses are less apt to develop due to shifting of the sand cushion. The Borough of Manhattan, New York City, the City of Baltimore, the City of Philadelphia and a number of other localities have recently adopted the cement-sand cushion.

The standard practice with reference to the grout for the joints calls for a 1:1 cement grout mixture. There has been a number of experiments in recent years with a mixture of bituminous material and sand for fillers. These experiments were undoubtedly carried on more extensively in the Borough of Manhattan, New York City, than any other place and to a somewhat limited extent in the City of Philadelphia and other cities.

These fillers consist of different mixtures, ranging from 30 to 40% of sand mixed with bituminous material—either tar, asphalt or tar and asphalt mixed. In Baltimore, they have obtained very good results with an asphalt filler used by the following method: They pour hot asphalt to a depth of 1 in. about 1 in. depth of hot gravel, and repour and refill with hot asphalt and hot gravel alternately until the joints are flush. I am informed that this usually takes approximately four pourings. After the joints are filled, the hot asphalt is squeegeed over the entire surface of the blocks and hot gravel is then thrown over this before traffic is allowed on the pavement. This gives an asphalt surface about ⅛ in. deep on top of the granite block, giving the street the appearance of a sheet asphalt pavement.

In using the mixture of sand and asphalt such as has been used in New York, the block is also covered to a certain extent with the bituminous mixture. In some cases it has been squeegeed over the entire surface. The object in the Borough of Manhattan and the City of Philadelphia, however, is not to do any more than fill the joints with the bituminous filler. It would seem as though, where there is a desire to cover the pavement with the bituminous material and make it resemble an asphalt pavement, that it might be just as well to lay an asphalt pavement in the first place. This method, however, might have its advantages, for example, in cases where the traffic is not very heavy, but it is expected that it will be very heavy within a couple of years, and it is desired to have a smooth asphaltic surface in the meantime, and also when it is desirable to lessen the noise for this period.

The best results in granite block construction are undoubtedly obtained with the cement grout filler, and it would seem to be good practice in every instance to make arrangements to close the street the additional 7 to 10 days and construct the pavements with grout fillers. Of course, there are some streets that it is practically impossible to keep the traffic off for this length of time, and in such cases, it will be necessary to use the bituminous filler, but there are a number of instances where bituminous filler is used, where the traffic conditions have been such that the street could be closed for a long enough time to use the cement grout filler.

The old method in using cement grout filler was to fill the joints for a certain depth with pea gravel and then pour the cement grout filler. It has been found, however, that better results are obtained by eliminating the gravel entirely and filling the whole joint with the 1:1 mixture, and this method is used exclusively in a number of cities. There has been considerable discussion relative to the best means of mixing the grout. Of course, just as good grout can be mixed by hand as by machine, provided it is given the proper attention, but more uniform results will be obtained by adopting the machine mixing method, as this eliminates the human element which often is not properly controlled.

The cement grout, of course, must be kept thoroughly agitated until it is poured into the joint, and the blocks should be thoroughly sprinkled before the filler is placed in the joints. The following is the method of pouring the grout in the City of Philadelphia and is more or less standard:

> Immediately after the blocks are laid they shall be rammed so as to leave no blocks above or below the general surface of the finished pavement. After the blocks have been brought to a uniform surface, and wetted by sprinkling with water, grout filler, composed of one part of Portland cement and one part clean, sharp sand mixed with clean, fresh water, shall be broomed into the joints, and the operation shall be continued as the grout settles, until the joints are thoroughly filled flush with the surface of the blocks, immediately after which the entire pavement shall be broomed to a smooth surface, sufficient grout being applied to bring the surface even with the highest part of any of the blocks. A squeegee scraper shall be used on the last application of the grout. In mixing the grout, mechanical grout mixers of a type to be approved by the engineer shall be used. The sand and cement must be measured previously to being placed in the machine, after which water shall be added in a quantity sufficient to give the grout the proper consistency. Care must be exercised to insure that the mixing is continued for a sufficient length of time, and in no case shall this time be less than one minute. If the grout has to be carried for any considerable distance from the point of mixture, it must be carried in watertight carts properly equipped to automatically agitate the grout during its transportation from the mixer to the point of application, or, in lieu of this, the grout must be thorough agitated by hand just previous to its application. Special care must also be exercised to insure that the grout as applied on the work is of a uniform consistency. Within one-half to three-quarters of an hour after the last application has been made and the grout between the joints has fully subsided and the initial set is taking place, the whole surface shall be lightly sprinkled with water, and the surplus grout left on the top shall be swept into the joints, bringing them up flush and full. After the grouting is done and a sufficient time for initial set has elapsed, so that a coating of sand will not absorb any moisture from the grout, ½ in. of sand shall be spread over the whole surface. When the work is subjected to an air temperature of 75° F, or more, the sand shall be sprinkled three times a day for three consecutive days. The highways shall be kept closed to traffic for at least seven days. Should the bond between the blocks become broken, the joints shall be cleaned out, even if it is necessary to take up and relay the blocks. The part so taken up and relaid shall be regrouted and protected for at least seven days until hardened.

All of these essential details, which, carried out to the letter of the law, go to make up a good pavement, appear to be so simple that in many cases, the inspector and the workmen are more or less lax, the result of which will show in the construction immediately after it is completed or within the next few years. A good job can only be obtained by strict attention to these apparently trivial but very essential details in the construction. The pay of inspectors on highway work usually ranges from $3.50 to $6.00 per day, and most engineers with experience will bear out the statement that a thoroughly capable inspector, judged by the standard of the average highway inspector, is worth $10.00 per day to the community.

A great many of the failures in paving construction are due, not always to dishonest inspection but careless inspection, and it would seem as though this branch of the service has not been given the consideration it should, and if it is necessary to pay $10 per day to obtain the right kind of inspectors, it would be far better to do so than to lose more than the increase in salary through poor work as obtained through careless inspection.

In order to give some idea of the comparative annual costs of the different types of pavements, the accompanying abstract from a paper presented by the author on December 23, 1916, to the American Association for the Advancement of Science, in New York City, has been embodied in this paper, together with some explanatory notes.

Annual Costs of Pavements

There has been considerable discussion relative to the advisability of paying the entire cost of repaving out of current taxes. Such a method of financing, of course, would result in a lower annual cost to the city because there would be no loan interest charges to pay, it being necessary only to set aside a certain sum annually in a sinking fund to replace the pavement at the end of its economical life. While this method results in adding to the government's assets by providing a wider margin of debt limit and in lessening the carrying charges, it is nevertheless the more costly method of financing for the taxpayer, who is one of the stockholders of the government. For example, when repaving is paid for out of current taxes, if it would cost the taxpayer $100 to pay for his share, he would lose the use of that money. On the other hand, if he elected to pay an amount per year equal to the interest and sinking fund charges to redeem a bond running for a term equal to the theoretical economical life of the pavement, which we will say is 20 years and through which funds were provided to construct the pavement, the taxpayer could deposit his original $100 in a savings fund bank at 4% compound interest and it would amount to $219 in 20 years, while the total annual interest and sinking fund charges that he would pay, based upon the bond issue method of payment, would amount to $147 at the end of 20 years, which would be $72 less than the sum accumulated at compound interest on his original $100. As all communal governments should be conducted in the interest of the people, it would, therefore, seem that the less costly method of financing for the taxpayer is to pay the interest and sinking fund charges annually on loan funds for the period of economical life of the pavement or serial bonds in order that he may retain the benefit of being able to invest at compound interest the funds equal in amount to the original cost of the pavement.

In discussing the methods of financing pavements with reference to a particular municipality, town, township or state, it should be borne in mind that the pavements only constitute a part of the necessary structures or improvements upon which the whole scheme of financing is based. In other words, the terms for which the bonds are sold may, as a matter of expediency, be based upon the average economical life and proportionate values of all of the several classes of structures. An illustration is in the following quotation from the 1915 report of John M. Walton, Controller of the City of Philadelphia:

> Life of City Property.—The question has been raised as to the propriety of including short lived equipment in the prop-

ANNUAL COSTS OF FINANCING PAVEMENTS ON LOAN FUNDS, PLUS ESTIMATED MAINTENANCE COSTS.

City Street Pavements.

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)
SHEET ASPHALT:	($1.90)									
6-inch concrete base course..........	.85	40(a)	23	$.03	$.2231	$.1740	$.1324	$.1592	$.1506	$.1579
1½-inch surface and 1-inch binder courses	1.05	17								
VITRIFIED BLOCK:	($2.65)									
6-inch concrete base course..........	.85	40	19	.04	.3688	.2851	.2129	.2448	.2325	.2417
4-inch surface and 1-inch sand cushion courses	1.80	15								
GRANITE BLOCK:	($3.45)									
6-inch concrete base course..........	.85	40	36	.005	.2181	.1603	.1012	.1748	.1555	.1732
5½-inch surface and 1-inch sand cushion courses	2.60(b)	34								
WOOD BLOCK:	($3.00)									
6-inch concrete base courses........	.85	40	24	.03	.5296	.2534	.1887	.2311	.2150	.2267
4-inch surface and 1-inch 1:4 cement mortar cushion courses............	2.15	20								
ASPHALT BLOCK:	($2.45)									
6-inch cement concrete base course..	.85	40	18	.06	.3755	.2951	.2271	.2544	.2452	.2535
3-inch asphalt block surface and 1-inch 1:4 cement mortar cushion courses	1.60	14								
BITUMINOUS:	($1.80)									
6-inch concrete base course..........	.85	40	20	.05	.2574	.2046	.1598	.1828	.1760	.1824
1½-inch surface and 1-inch binder courses	.95	14								
BITUMINOUS:	($1.55)									
6-inch concrete base course..........	.85	40	17	.05	.2624	.2083	.1625	.1792	.1722	.1774
2-inch surface course	.70	10								
Suburban and Country Roads.										
BITUMINOUS:	($1.65)									
5-inch concrete base course..........	.70	40	26	.03	.1813	.1428	.1102	.1353	.1265	.1332
1½-inch surface and 1-inch binder courses	.95	20								
BITUMINOUS:	($1.40)									
5-inch concrete base course..........	.70	40	22	.04	.1893	.1514	.1190	.1384	.1316	.1369
2-inch surface course	.70	15								
BITUMINOUS:	($1.30)									
6-inch broken stone base course......	.60	20	15	.04	.2456	.1932	.1489	.1588	.1527	.1569
2-inch surface course................	.70	12								
BITUMINOUS:	($1.20)									
3-inch broken stone base course......	.60	20	14	.04	.2495	.1961	.1510	.1581	.1497	.1536
3-inch penetration surface course....	.60	10								
CONCRETE, REINFORCED:	($1.45)									
6-inch concrete course	1.45	20	20	.04	.2087	.1658	.1294	.1467	.1415	.1467
WATER BOUND MACADAM:	($1.00)									
8-inch telford base course............	.50	30	15	.06	.2152	.1756	.1421	.1505	.1468	.1499
4-inch broken trap rock surface course bituminous surface treated........	.50	10								
WATER BOUND MACADAM:	($1.00)									
4-inch broken stone course..........	.50	20	14	.06	.2346	.1901	.1524	.1584	.1514	.1547
4-inch broken trap rock surface course bituminous surface treated........	.50	10								

EXPLANATION OF TABLE

COLUMN A; CHARACTER OF PAVEMENTS: Only the more extensively used types of construction have been considered. Each pavement has been sub-divided into its two component parts, namely, base course and surface course, for consideration separately with respect to estimated first cost and economical life.

COLUMN B; ESTIMATED FIRST COST PER SQUARE YARD: The indicated values are arbitrarily based upon the approximate average unit prices prevailing during the past several years. Where necessary, due allowances should be made, however, in specific localities, and at such times as the current market prices of labor and materials make revisions necessary.

COLUMN C; ESTIMATED ECONOMICAL LIFE IN YEARS: The estimated economical life values are based upon the assumed life of the base and surface courses, respectively, of the different types of pavements under the average traffic conditions for which each specific type is best suited.

COLUMN D; MATHEMATICAL MEAN ECONOMICAL LIFE OF BASE AND SURFACE COURSES WITH RESPECT TO THE FIRST COST AND ECONOMICAL LIFE OF EACH: The indicated mathematical mean life figures are empirical values. They were derived by the following method: If the annual sinking fund charges for the base and surface courses are added together, this sum taken as an annual sinking fund charge will at the end of a certain period of years accumulate an amount equal to that of the total unit cost of the pavement. This period of years, which may be interpolated from a sinking fund table, is considered to be the mathematical mean economical life of the pavement.

COLUMN E. ANNUAL MAINTENANCE COSTS PER SQUARE YARD: The indicated annual maintenance costs include such repairs as are necessitated by service wear and the application of bituminous surface treatments to water bound macadam pavements.

COLUMNS F, G, H AND I; SINKING FUND AND INTEREST CHARGES ON SEPARATE BONDS FOR THE BASE AND SURFACE COURSES, RESPECTIVELY, PRO RATED ANNUALLY OVER THEIR ESTIMATED ECONOMICAL LIFE PLUS THE ANNUAL MAINTENANCE COSTS: (Column F, 50-year bonds, column G, 30-year bonds, column H, 10-year bonds [c]): The costs under term bonds for periods of 10, 30 and 50 years, respectively, include the sinking fund charges (based upon the assumption that a sufficient sum be set aside each year and invested to earn 4% compound interest, which fund plus the earned interest will amortize the face value of the bond at its maturity, and the total net amount thus paid into the sinking fund is pro-rated in equal annual charges over the entire economical life of the base and surface courses respectively), plus the interest on the loan funds (which is the total amount of interest at 4% per annum paid during the term of the loan, pro-rated in equal annual charges over the entire economical life of the base and surface courses respectively), plus the annual maintenance costs.

COLUMN I (AS ABOVE); BONDS FOR PERIOD EQUAL TO ESTIMATED ECONOMICAL LIFE OF BASE AND SURFACE COURSES, RESPECTIVELY: The costs under economical life bonds include the annual sinking fund and interest charges on two bonds extending for terms equal, respectively, to estimated economical life of the base and the surface courses, plus the annual maintenance costs.

COLUMN J; REDEMPTION INSTALLMENT AND INTEREST CHARGES ON SERIAL BONDS FOR PERIODS EQUAL TO MATHEMATICAL MEAN ECONOMICAL LIFE OF BASE AND SURFACE COURSES, PLUS ANNUAL MAINTENANCE COSTS: The costs under serial bonds include the annual proportional part of the original loan fund extending for a period equal to the mathematical mean economical life of the pavement, which is redeemed each year by installment payments, plus the interest on the unpaid balance of the loan fund, plus the annual maintenance costs.

COLUMN K; SINKING FUND AND INTEREST CHARGES ON TERM BONDS FOR PERIODS EQUAL TO MATHEMATICAL MEAN ECONOMICAL LIFE OF BASE AND SURFACE COURSES, PLUS ANNUAL MAINTENANCE COSTS: The costs under mathematical mean economical life bonds include the average annual sinking fund and interest charges on a bond extending for a period equal to the mathematical mean economical life of the base and surface courses, plus the annual maintenance costs.

NOTES

Reference a (Concrete Base Courses): The economical life of the concrete foundation courses have, in all cases, been based upon the assumed necessity of replacement due to its condition caused by openings and other causes.

Reference b (Salvage of Old Granite Blocks): At the expiration of the economical life of the surface course of the granite block pavement, the old blocks have a salvage value of 50 ct. per sq. yd., which value has been pro-rated over the economical life and is deducted in the indicated annual costs.

Reference c (10-Year Bonds): The 10-year bonds, while less costly to the city than bonds running for the estimated economical life of the pavement are, however, more costly to the taxpayer, as they require a greater outlay each year.

erty account, and of buying equipment that will last but a few years out of 30 year bonds. I believe that your procedure in this regard has been a perfectly safe one in the past and consider that a continuance of such practice is safe so long as the expenditures of loan moneys for improvements that will last considerably in excess of 30 years greatly outweighs as at present the inconsiderable expenditures of loan moneys for short lived equipment. Annual estimated depreciation in 1915 and subsequent years is and will be charged to expense so that the current revenue of each year will have to bear its fair share of burden for depreciation on property and equipment and the resulting operating deficit or operating surplus will show clearly whether current revenues are sufficient to meet all the expenses of the year, including upkeep and replacement of the city's property and equipment.

The average life of each dollar's worth of city structures, non-structural improvements and equipment at present is 60.62 years. Taking the property and equipment separately, the average life of each dollar's worth of structures and non-structural improvements is 62.72 years; while the average life of each dollar's worth of equipment is 21.92 years. The fact that the average life of the equipment and property combined is only 2.1 years less than the average life of the structures and non-structural improvements apart from the equipment is owing to the fact that the city, for every dollar that it has invested in its equipment, has $18.50 invested in its structures and non-structural improvements.

In view of the fact that there are so many considerations entering into the determination of the financial policy of different states, municipalities, towns, townships and counties, it would seem in the general engineering discussions of the annual unit costs of pavements that the annual interest and sinking fund charges on term bonds or the annual cost on serial bonds including interest, to redeem a proportionate amount of the loan each year, extending over a period equivalent to the theoretical economical life of each of the respective types of pavements plus the annual maintenance costs should be considered to represent the annual unit costs.

The accompanying table has been compiled to give a general idea of the relative first cost values of the different types of pavements, and their costs per square yard per year, based upon the annual interest and sinking fund charges plus the maintenance costs for periods of time equivalent to bond issues maturing in 10, 30 and 50 years, serial bonds and also bonds for a time equal to the estimated economical life of the base and surface course respectively of the different types of pavements, and the mathematical mean economical life.

The consideration of the mathematical mean economical life of the base and surface courses was deemed desirable for the purpose of general discussion relative to the economical life of pavements and their costs. The figures indicated in column D of the table represent the mathematical mean economical life of each respective type of pavement based upon the estimated economical lives and relative costs of the base and surface courses.

The maintenance cost values and the estimated economical life given in the table are only approximate and are based upon average conditions and are not intended to represent definite data applicable to any city or locality.

The actual maintenance costs of pavements cannot be determined for 10 or 15 years, or until some of the annual maintenance cost data records now being kept in a number of localities have extended over a period of years equivalent to the actual economical life of the several types of pavement. In the meantime certain assumptions will have to be made, based upon scientific research and the experience and judgment of qualified highway engineering experts. It should be borne in mind, however, that a similar procedure was necessary in the infancy of life insurance companies and other undertakings dependent upon knowledge of probable future conditions for which no reliable existing data were available.

Of course, the fact that each of these different types of pavements is usually constructed to meet specific traffic conditions should be taken into consideration. For instance, a granite block pavement on a concrete base, costing $.1732 per sq. yd. per year would be constructed upon a heavy traffic city street, whereas a bituminous pavement on a broken stone base costing $.1569 per sq. yd. per year would be used on a suburban or country road carrying comparatively light traffic, and likewise, the concrete and bituminous types of pavement, while they may show a higher annual cost than water bound macadam, are figured for traffic conditions where water bound macadam would not be suitable. The following data are given to illustrate the comparative costs of several extensively used types of pavements subjected to similar traffic and other conditions.

COMPARISON OF ANNUAL COST DATA FOR SHEET ASPHALT, WOOD BLOCK AND GRANITE BLOCK PAVEMENTS SUBJECTED TO SIMILAR TRAFFIC AND OTHER CONDITIONS.

Character of Pavement:	Estimated Mathematical Mean Economical Life of Base and Surface Courses.	Estimated First Cost.	Total Annual Cost.
Sheet asphalt.......	17	$1.90	$.1862
Wood block.........	20	3.00	.2507
Granite block.......	40	3.45	.1851

It will be noted from the table that two asphalt pavements may be constructed for less than the cost of a granite block pavement, but from the standpoint of convenience to business interests and the general public, a granite block pavement may ulitmately prove to be the less costly due to the fact that it will be unnecessary to disturb the pavement during its economical life, which, of course, is considerably longer than that of a sheet asphalt pavement.

It is estimated that there are a number of very heavy traffic streets in the business sections of such cities as New York, Chicago, Philadelphia and Boston, where a sheet asphalt pavement would last not more than seven years, while a granite block pavement would last seventeen years. The following cost data are given for situations of this character:

COMPARISON OF ANNUAL COST DATA PER SQUARE YARD FOR SHEET ASPHALT AND GRANITE BLOCK PAVEMENTS SUBJECTED TO SIMILAR VERY HEAVY TRAFFIC AND OTHER CONDITIONS.

Character of Pavement:	Estimated Economical Life in Years of		Estimated First Cost of		Maintenance.	Interest and Sinking Fund Charges.	Total Annual Cost.
	Base.	Surface.	Base.	Surface.			
Sheet asphalt	40	7	$.85	$1.05	$.06	$.2178	$.2778
Granite block	40	17	.85	2.60	.03	.2566	.2572

The total annual cost of granite block pavement as indicated in the preceding table includes a deduction of $.0294, which represents a salvage value of $.50 per sq. yd. for the old granite blocks at the expiration of the pavement's economical life pro-rated in annual deductions over the economical life of the pavement.

Views of Exhibits at the Eighth National Good Roads Show

On the two pages following (138 and 139) are shown views of the exhibits at the Eighth National Good Roads Show held February 5-9 at Mechanics Building, Boston, Mass., in conjunction with the fourteenth annual convention of the American Road Builders' Association.

The illustrations comprise two general views in the materials section on the main floor and eight views of different exhibits in the materials and machinery sections.

A complete list of the exhibitors was printed in "Good Roads" for February 17, 1917, page 109.

View Looking Toward Rear of Hall from Near Stairway to Machinery Section.

View of Foyer and Exhibits from Main Entrance.

GENERAL VIEWS OF EXHIBITS IN MATERIALS SECTION OF THE EIGHTH NATIONAL GOOD ROADS SHOW AT MECHANICS BUILDING, BOSTON, MASS., FEB. 5-9, 1917.

SOME OF THE EXHIBITS AT THE EIGHTH NATIONAL GOOD ROADS SHOW.

Increased Paving Costs

(Contributed)

This is the time of year when paving contractors immediately become possessed with the idea that the first paving jobs to be let constitute all the work which will ever be done again in this world. The result is that work advertised early in the year frequently goes at prices too low to permit of a living profit. This is not the principle adhered to by successful business concerns in other industries, and there is no good business reason why this condition should obtain among paving contractors. Each year the volume of paving to be performed in the southern states has shown a healthy increase, but this fact has not been taken into consideration by most paving contractors.

The year 1917 opens under abnormal conditions such as the world never before has seen. Today the paving contractor faces increased costs in all lines of materials, and particularly in labor. It might prove of interest to explain that in practically all of the large northern cities, on the average, not more than half of the paving work awarded last year has been completed. This delay has been occasioned by an impoverished labor market, and by inability to secure materials entering into the work. In the North, East and West the paving prospects for 1917 are greater than in any previous year in the history of the country. All this work will have to be performed, and in those sections there also remains the uncompleted work held over from last year. Quite a lot of work has been held over in the southern states from 1916, and in the South the paving contractor is beginning to feel the rising cost of labor, and the poor quality of labor obtainable will likewise add greatly to the cost of work. Prices on all paving materials are increasing rapidly, and it is daily becoming more difficult to secure delivery of necessary materials.

In their mad excitement to secure a paving contract, unfortunately some paving contractors give scant heed to the underlying conditions governing their business. In the past, some paving contractors have taken work at close prices, depending upon making the major portion of their profit by buying materials at lower prices than those quoted at the day of the letting. All these conditions have been radically changed. Today labor is scarce, expensive and poor. Today materials are higher in price and going higher almost every week. Today it is virtually impossible to secure deliveries in certain parts of the South on some materials going into the construction of pavements. Contractors, when bidding upon a job, frequently forget that they cannot put quoted prices into the street, but that it takes paving materials to build the pavement. Prices are merely an evidence of first cost. It should be remembered that delay in securing deliveries of materials frequently obliges the suspension of operations, and such suspensions all contractors know are costly.

Bidding upon a paving job in the South today, a paving contractor who exercises wisdom and sound judgment will make his price in keeping with the actual conditions existing in the business, bearing in mind the fact that every item of cost is on the increase, and that he must figure upon his work costing him more each month, perhaps until the European war is brought to a close. Careful and conservative contractors will see that they do not become so extended in their operations that in the event that this country should become forced by world-wide conditions to abandon its position as a neutral nation they will become financially embarrassed. This is a time for careful thought by all American business men, and this statement applies with equal force to paving contractors as to business men engaged in any other line of commercial or industrial activity.

It is a well known fact that other sections of the country are withdrawing the best negro labor from the South as rapidly as possible. It has been predicted that this labor would not remain North, but would rapidly return to the South. Up to date there is no evidence that this prediction is true. On the contrary, the negro labor seems to be content to remain in the North, especially during the present season of high labor prices.

During the year 1917, whenever a paving contractor starts to bid on a job, if he is a wise man, he will first sit down and have a careful talk with himself and give his balance wheel a chance to work.

Large Paving Contract to Be Let in Waterloo, Iowa

The contract for paving approximately nine miles of streets in Waterloo, Iowa, will be awarded on Feb. 26. According to plans the work is to begin not later than April 15 and is to be completed by Dec. 1. Bids will be received on sheet asphalt, creosoted wood block, brick, asphaltic concrete, concrete, tarvia, bituminous and water bound macadam. Streets on which work will be done are the following:

Falls Ave., Beck Ave., Manhard St., Duryea St., Sullivan Ave., Summit Ave., Reber Ave., Kimball Ave., Kingsley Ave., Sunset Road, Fourth St., Williston Ave., Vermont St., Bayard St., Baltimore St., Bertch Ave., Hawthorne Ave., First St., Commercial St., Home Park Boulevard, Fletcher Ave., Kingsbard Ave., Ninth St., Prospect Ave., Alta Vista Ave., Glenwood St., Irving St., Parker St., Burton Ave., Conger St., Oakland Ave., Whittier Ave., Bryant Ave., Longfellow Ave., Greenwood Ave., Glen Ave., Riehl St., Norwood St., Riverside Drive, Lafayette St., and Lincoln St.

Federal Aid Road in Apache National Forest

The location survey of a section of the first project in road construction submitted under the portion of the federal aid road act applying to national forests, has been authorized by the Secretary of Agriculture. The proposed road is in the Apache National Forest, Greenlee County, Arizona.

The preliminary estimate of the cost of construction of the 71 mi. of road to be surveyed is $342,500. Greenlee County proposes to hold a bond election to raise the necessary funds to contribute 50% of this amount. An additional 29 mi. of road will be necessary to complete the project, bringing the total estimated cost to $420,000. The construction of the road will make possible a north and south trunk line through a region now inaccessible, and will connect with existing east and west state highways. In addition, it is stated, the road will afford means of travel for settlers, will assist the development of water power in the region, provide a recreation area for tourists and residents of the desert cities in summer time, at the same time cheapening the cost of protecting and administering the Apache National Forest.

The Washington-Atlanta National Highway between Fayetteville and Wade, in Cumberland County, North Carolina, a distance of 11 mi., is to be entirely rebuilt. This action was decided upon at the November meeting of the Board of Cumberland County Commissioners.

Lehigh and Northampton Counties in Pennsylvania are soon to have full representation on the Board of Governors of the William Penn Highway and in the affairs of the association generally. The constitution, which originally provided that only the counties between Philadelphia and Pittsburgh should have representation, was changed at a recent meeting to include Lehigh and Northampton Counties, and a governor and other officers will be elected for these counties at the annual meeting of the association, March 26. It is expected that the coming summer will see the William Penn Highway in permanent condition from Philadelphia to Johnstown with the exception of a few miles between Liverpool and Clark's Ferry, Dauphin County. The unfinished link between Bethlehem and Allentown will be connected and permanent work will be done between Allentown and Reading.

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Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

FEBRUARY 24, 1917.

CONTRACTORS' EQUIPMENT

The paper by John H. Gordon, presented at the recent A. R. B. A. convention at Boston and printed on other pages of this issue, deals with a topic which is especially timely just now. Within a comparatively short time the road building season will open and with the beginning of work the matter of equipment will become one of the contractor's most serious problems.

Road work, with the varying local conditions encountered and the frequency of comparatively small jobs often situated at considerable distances apart, requires the contractor who hopes to be successful to devote more than ordinary attention to the selection of proper equipment and to its care and use. This is especially important at present because of the difficulty of obtaining labor and the consequent necessity of utilizing labor saving machines to the utmost.

The gathering together of equipment best suited to the work which the contractor expects to do, and the most efficient and economical use of his plant, require a thorough knowledge of road machinery and tools as well as of methods of work, of material markets, of handling labor or of the financial end of the business. The larger contractors and contracting firms have organizations large enough to include men who do have such knowledge. The smaller contractor, however, is apt to lack a thorough knowledge of the possibilities of plant, and, as pointed out by Mr. Gordon, plant is one of the two principal factors in the ultimate success of the contractor—the other being organization.

While, in contracting as in everything else, experience is the best guide, there are many other means by which the progressive contractor can familiarize himself with what is available in the way of labor saving machines and tools. Exhibits of machinery, such as that held at Boston in connection with the convention of the American Road Builders' Association, offer most excellent opportunities for becoming acquainted with what is to be had. Indeed, as has been pointed out in these columns, the Good Roads Show offers unequalled opportunities of this kind. Other sources of information are the advertising pages of the journals covering the field in which the contractor is engaged and the trade literature of the manufacturers and dealers. While both of these mediums are appreciated by many, there are without doubt many others who do not realize how valuable advertisements and trade literature are. Some of the trade publications carelessly classed as catalogs are really text or reference books of high order.

Plant or equipment, as has been pointed out, is a factor of the greatest importance in the contracting field and it is entirely conceivable that under conditions such as have obtained during the past two working seasons and are likely to again obtain during the season to come the judicious use of machinery may make the difference between profit and loss for some contractors in the road building field.

THE A. R. B. A. PROCEEDINGS

With this issue there is completed the publication of the technical papers presented at the Boston convention of the American Road Builders' Association. These papers are of unusual merit and are worthy of preservation in the files of engineers engaged in the work with which they deal.

Of equal—perhaps greater—value are the discussions which followed the papers. A paper, as a rule, is the result of the observations and experience of one man, while the discussions are participated in by a number of different individuals, each of whom brings to the consideration of the matter involved a question or suggestion from his own work.

Because of the limited space at its disposal neither "Good Roads" nor any other publication can print the full text of the discussions nor find space for enough of them to give the reader the full benefit of the views of the speakers. A verbatim report of the convention is, however, printed in the official proceedings of the American Road Builders' Association. Copies of these may be obtained in two ways—by joining the organization or by purchase. The dues of the association are $3 a year and in previous years the "Proceedings" have been sold for $2 a copy. Either amount is easily within the means of the highway engineer and will prove a most profitable investment.

COST AND DURABILITY OF CEMENT CONCRETE PAVEMENTS

Elsewhere in this issue we print a letter from a subscriber who takes issue with the claims advanced regarding the life and cost of cement concrete pavements.

The communication is of particular interest to engineers and road officials in view of the growing popularity of the all-concrete pavement, for there is no question but that since its advent only a few years ago this type of pavement has grown in favor with remarkable rapidity. How much of this extensive use is due to its inherent qualities and how much to able promotion is a matter upon which there is wide difference of opinion.

Portland cement concrete, like every other material, has its proper place in road building. It finds its greatest use as a foundation where strength and durability are required. As a wearing surface it possesses certain advantages when new, but neither the condition of the older pavements of this type nor the length of time concrete pavements—as now built—have been in use warrants predictions as to the future.

Whatever other errors have been made by the promoters of the all-concrete pavement, there can be no question but that the claims advanced as to the durability of the type have been exaggerated. It has been hailed as the "permanent" pavement and this "permanency" has been described as accompanied by incredibly low maintenance costs. At the same time it has been difficult to secure complete, detailed data on the actual maintenance work; and absolutely reliable data of this kind would be welcomed.

To Improve State Aid Roads in Peoria County, Illinois

Plans and estimates for the improvement of portions of three state aid roads in Peoria County, Illinois, have been approved by the State Highway Commission. Concrete is the type of construction decided upon, each road to be 15 ft. wide. The plans call for the improvement of the following:

Farmington Road from Dry Run Creek to a point near Kickapoo Creek, 1 mi., estimated cost $16,148.50; Mount Hawley Road from Knoxville and Prospects Aves. past Kellar Station, 2 mi., estimated cost $31,786.60; Galena Road from north limits of Peoria Heights to point near Payson farm, 2½ mi., estimated cost $38,078.88.

Contracts covering portions of the Mount Hawley and the Galena Roads were let some time ago, but were subsequently cancelled because the work was not started. One hundred thousand dollars has been appropriated for the improvement of the roads.

Highway Engineering Course at the University of Kentucky

The annual short course in highway engineering held by the Highway Department of the University of Kentucky, Lexington, closed on Feb. 10, with the general expression that it had been the most successful of any previous meeting.

GROUP OF ATTENDANTS AT THE ANNUAL SHORT COURSE IN HIGHWAY ENGINEERING, GIVEN AT THE UNIVERSITY OF KENTUCKY, LEXINGTON.

The course covered a period of one week and comprised a series of lectures arranged to cover in detail all the phases of present day road building. Addresses were made by engineers from the U. S. Office of Public Roads and Rural Engineering and from the Kentucky Department of Public Roads, and by other experts engaged in road work.

Although the registration this year was not so large as it has been in some years, the success of the meeting leads those in authority to contemplate holding a course covering a period of six or eight weeks in future years. This course doubtless would comprise some regular class work together with lectures by highways experts. Furthermore it would give those in attendance an opportunity to obtain valuable information and instruction through the very complete road building laboratory which is maintained at the university.

Maryland Roads to Be Improved

The Maryland State Roads Commission has decided upon the roads to be constructed with funds received from the government under the federal aid law. The roads are as follows:

Road leading from the southern limits of Frederick, including the Washington turnpike as far as the Monocacy River bridge, the Buckeyetown turnpike and the road near Dickerson to connect with the improved state road at Dawsonville, a distance of approximately 21 mi.

The Urbana turnpike, commencing at the south end of the Monocacy River bridge and running south towards Hyattstown, for a distance of 6 mi.

Road leading from Bladensburg to Camp Parole, known as the Old State Road, approximately 25 mi. in length.

Road leading from Oakland to Hutton to connect with the improved system of roads in Preston County, West Virginia, now under construction; total length, 4.50 mi.

Section of road known as the Philadelphia Old Post Road, leading from Herring Run to the Little Gunpowder Falls; total length, 12.50 mi.

Road leading from Corrigansville via Ellerslie to the Pennsylvania line joining the Pennsylvania system of roads; 2.40 mi. in length.

Road leading from the improved road at Westminster through Littlestown towards Gettysburg and joining with the Pennsylvania road system; total length, 11.50 mi.

The turnpike road leading from the improved road at Boonsboro through to Sharpsburg; a distance of 7 mi.

Easton to Claiborne, a distance of 10 mi.

Grove to Bureau, a distance of 5 mi.

Convict Work in Columbia County, Florida

In order to secure the largest possible improvement from the use of the $7,800 which Columbia County has available for road and bridge work this year, the county commissioners have decided to substitute convict labor for free labor on county roads. They propose to employ 15 state convicts, at an estimated cost per month as follows: 15 state convicts, $15; 1 general road man, $75; 2 guards at $25 each, $50; feeding 23 men (includes 5 county convicts, no charge) at 50 cts. a day, $345; clothing 20 convicts at $3, $60; 1 mule team upkeep, $30; doctor's bill, $12.50; miscellaneous items, $12.50; total, $610. Based on these figures, the expense for 12 months would be $7,320.

In addition to the above the county expects to purchase a steel cage for the safe keeping of the convicts, at a cost of $715. It is thought that by keeping the cage on the section of road that is building much time will be saved over past methods.

NEWS NOTES

The Board of Supervisors of Santa Clara County, California, has set March 15 as the date upon which the proposed bond issue of $1,500,000 will be submitted to the voters of the county.

Tentative Plans for Road Building in Warren County, Illinois, call for the improvement of about 90 mi. with bituminous gravel. The special roads committee of the Board of Supervisors has decided upon the roads to be improved. A map showing these roads, prepared by County Road Superintendent McClanahan, will be presented with the report of the committee to the Board of Supervisors at its March meeting. It is stated that it will be necessary to issue bonds to the amount of $750,000 to meet the cost of building the road system as laid out.

State Highway Routes and State Aid Roads in Pennsylvania have been under discussion during the past week by Commissioner Black and delegations from Northumberland, Erie and Blair Counties. Those representing Northumberland County sought to secure the improvement of State Highways 161, 182 and 283, particularly the portion running from Elysburg to Faxinos. The Erie County delegation presented their claims for a state aid application on file at the department for building the Wattsburg Plank Road. Senator F. W. Snyder represented Blair County, which requested that state highway route 55, between Tyrone and Altoona, be improved with a permanent type of pavement.

LETTERS TO THE EDITOR

Maintenance Costs of Portland Cement Concrete Roads

Editor, "Good Roads:"

Following publicity efforts of the National Cement Association, there is a great deal being said through the press to the effect that maintenance cost of Portland cement concrete roads is practically nil. For instance, the Kansas City, Missouri, "Journal," Aug. 17, 1916, credits Mr. George A. Ricker as stating before the Young Men's Division of the Commercial Club of Kansas City, that:

> In New York $4,500,000 was spent in the upkeep of roads already constructed during 1915. However, the upkeep of concrete roads is less than $50 per mi. per annum, while the average of roads constructed of all other kinds of material is in the neighborhood of $500 per mi. per annum.

This statement should be considered in connection with the fact that Mr. Ricker is one of the western district representatives of the Association of Portland Cement Manufacturers, which practically includes every cement manufacturing company in the country, since the organization of which the market price of Portland cement has advanced by leaps and bounds throughout the country, and incidentally quotations from time to time of every manufacturer are precisely the same as those of every other manufacturer.

It is a question well worthy of consideration as to what practical basis there is for such a statement on the part of Mr. Ricker and other similar statements which have been made by others that cement roads have been maintained for any considerable term of years at anything like the low basis of cost thus given out by the Portland cement interests. Unless such a statement is borne out by general experience covering a considerable term of years under different conditions of use, including traffic and climatic conditions, and is at least an average of those broadly varying conditions, then it is fair to say that it is absolutely unfounded and should not be made by either interested parties or others, and should not be given credence by the public.

Based on such a broad view and covering Portland cement concrete roads having had four or more years' use—which would seem to be as short a time as would warrant being regarded as of statistical value—it is probable that the "upkeep of concrete roads" would be found to have cost thousands of dollars per annum.

In the January, 1917, issue of "The Cement Era," devoted to cement and related machinery, there is an article entitled "Experiment in Resurfacing a Concrete Roadway." Referring to the entire resurfacing of an unnamed concrete road in Wayne County, Michigan, the article says: "The section of road chosen for the experiment was built in 1910 and is of two-course construction." While this article noticeably omits any reference to the cost of this resurfacing, it does show very clearly that in this Mecca (Wayne County) of Portland cement road construction, a road laid six years previously had required absolute renewal, and from the statement "section of road chosen," the inference is that other roads in Wayne County are of such condition that they might be selected for such "experiment" and that such additional roads do or in the very near future will require entire resurfacing or reconstruction in some form.

The article further says:

> All the Tarvia surfacing and filling used to cover the cracks was removed. The cracks and holes were then filled with concrete. * * * * * The expansion joints * * * * * were mostly worn down. Where the joint was spalled to a considerable extent the old concrete was broken away sufficiently to give a bond for new concrete on both sides of the joint.

All of which indicates that the concrete roadway must have been in extremely bad condition at the time of the experimental resurfacing.

It should also be stated, as outlined in detail in the "Cement Era" article, that the experiment consists of an entire resurfacing of the six-year-old concrete roadway by laying of "a 3-in. layer of 1:1½:2½ concrete. * * * The surface in no place is less than 3 in. thick, reinforced with No. 26 triangular mesh wire."

The inference is fair that in the worn places the new surface is considerably greater than 3 in. in depth and therefore the average depth of new concrete surface considerably more than 3 in.

Regarding traffic the "Cement Era" article says:

> During the week of Sept. 18, 1912, 7,580 vehicles—by actual count—passed the same point.

It is not for the present writer to state why the writer of the "Cement Era" article should have reported the total number of vehicles "during the week" instead of the common statistical practice of reporting the average **daily** or hourly traffic, either in number of vehicles or estimated tonnage, or both. It is, however, of interest to reduce the report of traffic for a full week to traffic per day and per hour, which we find to give an average of 1,083 vehicles per day, or 44 vehicles per hour, or less than one vehicle per minute, which it will be noted is not more than a very moderate traffic.

While, as noted above, the "Cement Era" article fails to give the information either as to the cost of experimental resurfacing of the road in question, or any report of the expense of general upkeep of Wayne County roads, the records show that, of the approximately 150 mi. of improved roadway in Wayne County, of which 125 mi. are Portland cement concrete, the maintenance cost for the first 8 months of 1916 aggregated $34,806, subdivided as follows:

Tarvia	$4,000
Labor	19,000
Oil	2,000
Gravel and sand	1,000
Rock at $1.50 to $2.30 per cu. yd.	8,000
Miscellaneous	806
	$34,806

As there is no Portland cement included in this cost of "maintenance items," it is apparent that the experimental resurfacing and probably other extensive repairs have been charged into the record of new construction and not maintenance or upkeep.

The issue of "Engineering and Contracting," published in Chicago, Jan. 3, 1917, contains an article under the title of "The Tendency Toward Use of More Cement and Greater Thickness in Concrete Roads," a tendency which the writer of the article discourages and recommends two-course construction, with the lower course to be in proportions of 1:4:8, and adds:

> The top layer should be rich, say 1:1½:3, and not more than 3 or 4 in. thick.

One important lesson to be drawn from all of the publicity suggestions regarding changes of details of cement road construction is the self-evident fact that there is no approximate agreement as to the general specifications which will give the best results, showing that the entire construction, as well as resurfacing outlined in the "Cement Era" publication, is distinctly experimental. Surely there is no basis for a fair statement that the "upkeep of concrete roads is less than $50 per mi. per annum," or any other small sum. Let us neither fool ourselves, nor the public, nor let the cement interests fool us and the public through us.

Incidentally, it is a matter worthy of serious consideration as to whether "the tendency toward use of more cement and greater thickness in concrete roads" is the result of publicity in commercial interests of the cement association, not only to double up the price of cement, but to double the quantity of its consumption, more or less regardless of what is really best or most economical for the public.

"READER."

Adequate Foundations for Roads and Pavements

Editor, "Good Roads:"

This company has been building pavements and roads and producing highway material for 33 years. We feel that our position in the road building industry imposes a certain responsibility upon us.

It is in the discharge of such responsibility that we point out a serious and costly error now being made in practically all communities; namely, the failure to provide adequate foundations for country roads and, in many cases, for city pavements.

Our roads are not wearing out by increasing quantity of traffic nearly as fast as they are being broken down by increasing weight of traffic.

The remedy for this condition is the adoption of more substantial bases for new roads in rural districts as well as in cities. Used in this way for foundations, concrete serves its true function as a road material. Protected by asphalt wearing surfaces it does not exhibit the heaving, cracking and disintegrating that is seen when concrete is exposed as a road surface to varying moisture and temperature conditions.

On the other hand, the support afforded by concrete to asphalt wearing surfaces is as beneficial in the building of enduring highways as is the protection of the base provided by such surfaces.

The road of asphalt and concrete is, therefore, the best dependence of those who desire durability and a means of carrying present traffic weights. It is earnestly recommended, therefore, that taxpayers and those who represent them should act in their own interest and demand, if concrete is to be used, that both it and asphalt shall be employed, not necessarily so as to consume the maximum amount of either, but so as to get maximum service from each.

The purpose of this letter to you is not to suggest that the ideas we express should be accepted by you unquestioningly, as gospel, but that you do permit them to effect such lodgement in your mind as will lead you to keep them before you and to test their accuracy at every possible opportunity.

The element of self-interest in these suggestions is this: That we believe the highest success of any product is dependent upon its wisest—not necessarily its largest—use.

A. W. SEWALL,
President, The Barber Asphat Paving Co.
Philadelphia, Pa.

MEETINGS

Calendar of Coming Meetings

February 19-24.—Southwestern Concrete Association—Annual meeting and show, Kansas City, Mo. Chairman of committee, Charles A. Stevenson, 1433 West 10th St., Kansas City, Mo.

Feb. 20-21.—Connecticut Society of Civil Engineers—Annual meeting, Mason Laboratory, New Haven, Conn. Secretary, J. F. Jackson, New Haven, Conn.

February 21-23.—Iowa Engineering Society—Annual meeting, Ames, Ia. Secretary, J. H. Dunlap, Iowa City, Ia.

March 5-6—National Paving Brick Manufacturers' Association—Annual convention, Hotel McAlpin, New York, N. Y. Secretary, Will P. Blair, Cleveland, Ohio.

March 5-7—American Ceramic Society—Annual meeting, Hotel Astor, New York, N. Y. Secretary, Edward Orton, Columbus, O.

March 14.—Vermont Society of Engineers—Meeting, Hotel Vermont, Burlington, Vt. Secretary, Geo. A. Reed, Montpelier, Vt.

April 17-20.—U. S. Good Roads Association.—Fifth annual convention, Birmingham, Ala. Secretary, J. A. Rountree, 1021 Brown Marx Building, Birmingham, Ala

Texas Good Roads Association

The sixth annual convention of the Texas Good Roads Association, held at Austin, Jan. 17 and 18, was one of the most important meetings in the history of the association, according to the report of its Secretary-Treasurer, D. E. Colp. The meeting was presided over by President Howard Bland, who reviewed the work of the past year and outlined plans for the future. A number of state senators and representatives took part in the program. The report of the secretary-treasurer showed that the membership of the association had increased 200% in about nine months, and that there was a good cash balance in its treasury. Mr. Colp referred to the work of the association as sponsor of the present legislation for the creation of a state highway commission for Texas.

"Permanency in Road Building" was the subject of an address by L. S. Franklin, of Dallas. County Judge S. A. Penix, of Big Spring, told of troubles that were experienced in getting the first bond issue for the county. An urgent plea for maintenance was made by Col. P. L. Downs, of Bell County. A wide range of subjects pertaining to road building was treated by members and other speakers among whom were Morris Stern, of San Antonio; Charles M. Kirk, of Houston; State Senator Carlos Bee, of San Antonio; H. A. Fisher, Secretary of the Red River to the Gulf Highway Association, Crockett; Julian Feild, of Denison; C. N. Avery, of Austin; County Judge Adrian Pool, of El Paso; Earl B. Mayfield, member of the State Railroad Commission; J. T. Land, of Fort Worth; J. P. Nash, Testing Engineer of the State University; Capt. J. D. Fauntleroy, U. S. District Engineer, Fort Worth; R. L. Morrison, Professor of Highway Engineering, Agricultural and Mechanical College of Texas; C. R. Gardner, Secretary of the Hill County Unit; John W. Warren, Chairman of the Legislative Committee of the association; State Representative R. L. Carlock, of Fort Worth; State Senator F. M. Gibson, of Bonham; Dr. A. Caswell Ellis, of the State University, and Dr. J. H. Eastland, of Mineral Wells, Texas.

At the annual meeting of the Minnesota Surveyors and Engineers Society held at Radison Hotel, Minneapolis, Feb. 7 to 9, inclusive, officers were elected as follows: President, John Wilson, Duluth; Vice President, C. H. West, St. Cloud; Secretary, T. D. Stirling, St. Paul; Treasurer, W. F. Rosenwald, St. Paul.

GOOD ROADS

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NEW YORK, MARCH 3, 1917

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Road Construction in Arizona

By THOMAS F. NICHOLS*

It is an interesting and curious trait of mind that leads us to attach surprising importance to certain imaginary lines upon the earth's crust. There would seem to be no sensible reason why any one should feel more satisfaction and pride over the construction of certain roads and highways in a remote region within his own state boundaries and over which he may never travel than he does over the construction of sections of roads just across some imaginary state boundary which is of real service to him. As a matter of fact, within the state boundaries of Arizona there are sections that are intrinsically more remote from the portion familiar to the majority of the inhabitants than are parts of Illinois and Ohio. It is possible, in fact, to select a habitation in Arizona from which one can reach his own county seat only by a 1,000-mile trip—provided the aeroplane and the burro are both eliminated as a means of transportation.

Few people outside of the State of Arizona realize the great variety of climate and topography to be found within the state's boundaries. The elevations range from practically sea level to nearly 13,000 ft. at the summit of Mt. San Francisco. The temperatures recorded at various government stations range from −30° F., or lower, to +127° F., or higher. The average annual precipitation in various parts of the state ranges from about 4 in. to over 40 in. and certain sections show an average snowfall of more than 40 in. annually, as contrasted with a large section of the state in which there is no snow at all.

The so-called desert areas of the state differ materially from the popular conception of deserts. In general, they are rather thickly covered with a great variety of plant growth, including, of course, almost endless varieties of cacti, and in addition to such, many shrubs and a few trees of a limited number and kind. These desert areas are characterized also by heavy rainfalls extending over brief periods of time rather than by a more even distribution of the small precipitation. The result of this climatic feature is that provisions for caring for run-off in the construction of highways through these desert areas must be made with the same care and completeness as in sections where the rainfall is many times greater. In some places in order to save great expense it is necessary to pave the wide washes with concrete instead of constructing long low bridges.

THE PHOENIX-TEMPE HIGHWAY IN ARIZONA—"CALICHE" SOIL.

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*Office Engineer, Arizona State Highway Department.

VIEW ON THE PRESCOTT-PHOENIX HIGHWAY IN ARIZONA—SHOWING ALIGNMENT AND GRADE.

Possibly it would be satisfactory to state that the road building problems in Arizona comprise all those to be met in building roads through desert countries, over large plateaus of about 4,000 ft. elevation, through rugged mountains, the elevations of which range from 2,000 to 5,000 ft., and in the foothills lying between the desert and mountain sections. It might be well to add to the above the special difficulty of road building through irrigated alluvial soils covering a considerable area.

A catalog of the various types of rock available in Arizona for road material would comprise most of the varieties of such material known in the other states of the Union, with one or two that are not found in the majority of the other states. There is widely distributed throughout Arizona a decomposed granite that makes a very satisfactory road surface for light traffic and an unsurpassed sub-base for a hard surfaced road for heavier traffic. A material known throughout the state under the name of "caliche" is also valuable and particularly adapted for carrying automobile traffic. This material resembles a natural concrete with low cementing properties in the matrix. The size, nature and grading of the aggregate varies through wide limits and is far from uniform even in the same locality, the value for road building purposes varying accordingly. In the northern part of the state a volcanic cinder is found that has considerable value as a road surfacing material. There are to be found in Arizona many miles of natural sand-clay road and much of the material is an exceptionally satisfactory mixture.

11-SPAN REINFORCED CONCRETE ARCH BRIDGE OVER SALT RIVER—PHOENIX—TEMPLE HIGHWAY.

In spite of the great extent of the resources of the state in the way of material for road building there are extensive areas that are far removed from such deposits. In the desert portion may be found large areas of river bottom land built up of a very fine silt. This silt has little or no value as a road building material and the cost of transportation on imported rock and gravel is very heavy. The value of these silt deposits for agricultural purposes is so great, however, that eventually some form of hard-surfaced road must be built through them at an expense that it now appears must necessarily be very great.

In the mountain regions the main problem is one of securing the proper grade and alignment, together with adequate provisions for surface drainage, without prohibitive cost. The scenery through these mountains is sufficiently attractive to repay tourists for the many hardships they now endure in endeavoring to negotiate the existing mountain roads. It is believed that the construction of certain highways through these mountain sections will result in a great increase in tourist travel within the state and might well repay the expense regardless of the requirements of the commercial traffic of the state.

CINDER SURFACE ON THE FLAGSTAFF-WILLIAMS HIGHWAY AFTER ONE YEAR'S USE.

Even with the highways partially improved, as at the present time, the tourist travel is steadily increasing. During the entire calendar year of 1915 the number of cars crossing the state via the northern or "Old Trails" route was reported to be 1,400. In the first nine months of 1916 the number of such cars passed the 1,500 mark. In the first nine months of the year 1916 tourist automobiles carrying an average of 3¼ passengers each, to the number of 1,200 had been accommodated at the garage at the Grand Canyon, and it was estimated that an equal number had passed through without patronizing the garage.

The laws under which the construction of highways is being carried on in Arizona have been in existence only about four years and will undoubtedly be modified in many ways within the next few years. They provide about $400,000 annually for expenditure by the State Engineer. In addition to this amount the various counties, by bond issues and direct taxation, raise a much larger amount, which is expended under their own supervision.

The expenditures made by the State Engineer are jointly under his control and that of the boards of supervisors of the various counties in so far as 75% of the total amount of the state road fund is concerned. The remaining 25% is jointly under the control of the State Engineer and Board of Control of the state. The law provides further than 75% of the amount contributed by each county to the state road fund shall be under the joint control of the State Engineer and the Board of Supervisors of that particular county and shall be expended within the boundaries of that county.

It is readily seen from the foregoing that only a beginning has been made in the construction of highways in Arizona and that the large expenditures that are necessitated by modern traffic must still be provided for.

Up to the present time the work done by the State Engineer has consisted almost entirely of grading, with the construction of necessary bridges and culverts providing ample waterway. The problem of providing a suitable hard surface for modern motor vehicles has been barely touched.

It would seem probable that in order to care for the requirements of this state in a proper manner bond issues will be absolutely necessary. In order to make such bond issues it will be necessary in the first place to amend the constitutional provision limiting the borrowing power of the state, or to require more comprehensive road building plans on the part of the federal government.

LAYING VOLCANIC ASH SURFACING ON A PORTION OF THE FLAGSTAFF-WILLIAMS HIGHWAY.

There will be no difficulty in providing the funds necessary to take care of Arizona's share in connection with the federal aid recently provided. As is well known, however, the funds provided by the federal aid act are by no means large and must be considered merely as a preliminary and preparatory allotment rather than as a considerable part of the actual requirements of the state receiving the same.

The State of Arizona has a prison population much smaller than most of the states that have developed convict labor for highway work. In spite of this fact, however, this state has been most progressive in organizing road camps composed of convicts working with guards and without guards on the state highways. This state maintains at all times an "honor" camp consisting of from 30 to 40 selected prisoners who work practically without guard on the construction and repair of the state highways. There is also maintained a camp consisting of from 80 to 100 prisoners working under armed guards on the construction of bridges and roads. These two small forces have accomplished a large amount of work and carefully kept cost data would indicate that there is a substantial saving to the state by so employing these convicts. The conclusion is easily reached, however, that the work must be carefully handled in order to show any substantial saving over contract or day labor work.

HAIRPIN TURN AND HILLSIDE PROTECTION DITCHES ON THE CLIFTON-SOLOMONVILLE HIGHWAY.

The Supervisors of Ogle County, Illinois, have decided to submit the proposition to bond the county for $500,000 for road purposes to the people.

Tulare County, California, is planning to issue bonds to the amount of $2,000,000 for constructing 200 mi. of road, including main arteries and connecting routes.

The Highway Authorities of Sussex County, New Jersey, will ask for bids on the Deckertown-Newton Turnpike, according to a report. The road will be of concrete construction, the section to be improved being approximately 6 mi. long.

The Work of Reducing the Mineola Hills in Montgomery County, Missouri, to a grade of 5% in order to straighten out what is said to be the only really bad stretch in the highway between St. Louis and Kansas City, will begin in early spring, according to a report. Since the cross-state highway was established, this part of the road has been the subject of much controversy.

A 42-FT. CUT IN GILA CONGLOMERATE ON THE CLIFTON-SOLOMONVILLE HIGHWAY.

The Cost of Maintenance of Wood Block Pavements in Minneapolis, Minnesota; A Correction

Attention has been called by one of our readers, Geo. W. Tillson, of Brooklyn, N. Y., to an obvious error in the paper "Recent Practice in Wood Block Pavements" presented by Ellis R. Dutton, Assistant City Engineer of Minneapolis, at the recent convention of the American Road Builders' Association at Boston, as printed in "Good Roads" for February 24.

In the table at the top of page 131, in which are given the maintenance costs on wood block pavements during the years 1907-1916, inclusive, the cost per square yard in the last column is given in dollars instead of in cents. As stated in the paragraph immediately preceding the table, the costs are in cents per square yard per year.

Due to a mistake in proof reading the dollar sign was inserted before the first amount in the last column.

Maintenance of Concrete Roads in Connecticut

Data on the methods and costs of maintaining concrete roads in the State of Connecticut were given in a paper presented at the recent meeting of the American Concrete Institute by W. LeRoy Ulrich, Superintendent of Repairs of the State Highway Commission. From that paper the following data have been taken.

The Connecticut State Highway Department's first work with concrete roads was done in the summer of 1913. Since that time concrete roads have been built as follows: 1914, 23.89 mi.; 1915, 8.73 mi.; 1916, 14.40 mi. In 1914 the cost varied from $1.10 to $1.35 per sq. yd., while the last contract awarded in 1916 was for $1.80 per sq. yd. Estimates for 1917 are based on an anticipated cost of about $2 per sq. yd.

The State Highway Department builds its mixed concrete roads on a flat subgrade, using a 1:2:4 mixture, 6 in. in depth at the edges and crowned ¼ in. per foot. Reinforcement is used where necessary and transverse joints are placed at intervals of about 30 ft. Ordinary tar paper is used for the joints, the number of thicknesses of paper depending on the temperature at the time the work is done. On roads where there are car tracks longitudinal joints are built parallel to and about 2 ft. distant from the rails. The pavements are finished by hand floating and brooming.

Roads under the control of the Connecticut State Highway Department are repaired and maintained by a division of the department entirely separate from the construction division. This division is in charge of the Superintendent of Repairs, who reports directly to the State Highway Commissioner. The state is divided into ten districts, so laid out that all parts of each district are easily accessible from a central point, where headquarters are established. There are nine supervisors of repairs, each in charge of one of these districts, and an assistant superintendent, who has charge of the remaining district. Each district is subdivided into sections, each in charge of a foreman, who reports to the Supervisor of Repairs in his district. These foremen act alone as patrolmen or may handle gangs of up to 10 or 15 men. This organization handles all of the repair and maintenance work with the exception of large reconstruction jobs.

Most of the work necessary on the concrete roads in charge of the State Highway Department consists of treatment of the joints. All joints are treated with tar during the hot weather of the first summer after the completion of the work and as often thereafter as necessary, but always in warm weather. The equipment used consists of a tar kettle of about 150 gal. capacity, a pouring pot of the type used in applying bituminous filler and a wire push broom. The force consists of two laborers. The joint is brushed clean and then filled with tar and covered lightly with sand or stone chips. The cost of this work varies with the condition of the joints and the price of labor. Small holes in concrete caused by the breaking out of foreign matter introduced into the mixture during construction are repaired in the same manner as are the joints.

Longitudinal cracks are the most frequent defects due to causes other than faulty construction. These are also treated in the same manner as are joints.

Records of the costs of maintenance for various contracts have been kept for a period of two years, 25 mi. of roads having been used in obtaining the figures. These roads carried all classes of traffic from the heaviest to the lightest. During the 2-year period the actual cost of tar work on the concrete surfaces amounted to $38.63 per mi. per year, or about 0.4 ct. per sq. yd. of traveled path per year. The cost of shoulder and drainage work was $28 per mi. per year, or 0.3 ct. per sq. yd. per year. The maintenance cost for the same period on the entire trunk line system, representing all classes of surfaces, was $585.18 per mi. per year, or 6.25 ct. per sq. yd. of traveled path per year.

Michigan State Highway Department in New Quarters

The occupation of new offices by the Michigan State Highway Department in the new addition to the Capitol National Bank Building, at Lansing, marks a new period in the growth of the department. In the old location in the State Building all available space had been utilized. The lack of room made it necessary to secure temporary space in the Capitol to handle certain branches of the work. With the increasing demands, the need of new offices became imperative, in order that not only might the present work be satisfactorily handled, but also that future expansion might be provided for.

The department will occupy the entire fifth or top floor, the over-all dimensions of which are 63x137 ft. A very effective division of this floor space has been made. The reception room and general office cover a floor space of 24x48 ft. From this open the offices of the commissioner, deputy commissioner, office engineer and assessment district engineer. A hall leads to the offices of the chief clerk, district engineers and bridge engineer, and to a large and well-lighted drafting room running the entire width of the building. Other important features are a large vault equipped with modern, all-steel filing equipment, instrument room, stock room, blue print room with a dark room attachment, and testing laboratory.

The Highway Department now ranks among the largest of the state departments. The nature of its work makes it one of the most important of the state activities. In its new offices it is equipped in a manner commensurate with the magnitude of the work which comes to it, and it will, therefore, be better able to serve the people of the state.

During 1916 the Ohio State Highway Commission awarded contracts for 610 mi. of road at an estimated cost of $8,000,000. On Dec. 1 contracts for 38 additional miles of improvement were let for roads in Brown, Butler, Clinton, Fayette, Hamilton, Harrison, Jefferson and Noble Counties.

A "Sioux Indian Historical Highway" along the Minnesota Valley, from Camp Release near Montevideo to Fort Ridgely, including historical spots relating to the Indian outbreak of 1862, and terminating at Mankato, is being promoted by the Minnesota Development Association, according to a report.

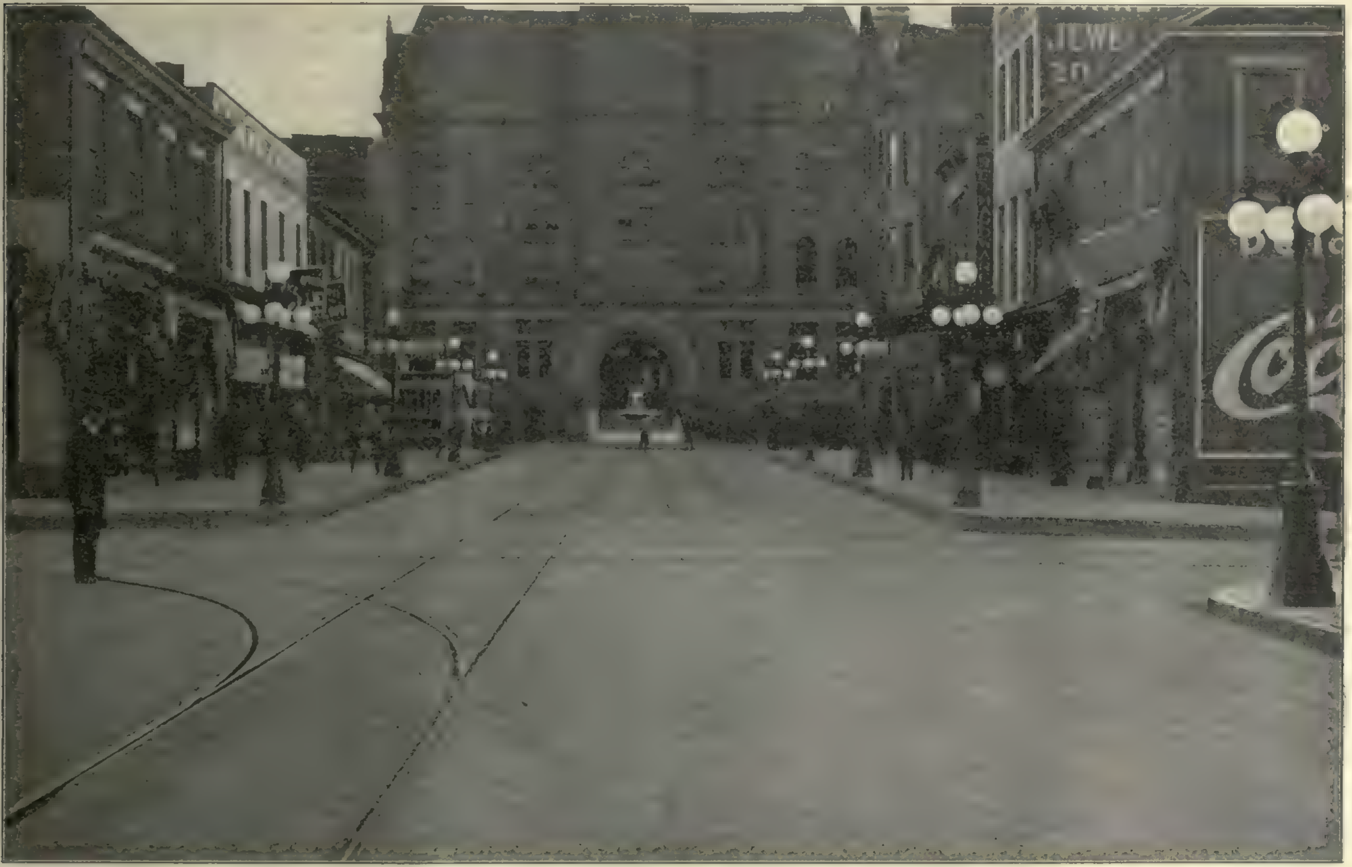
The Kansas Division of the King of Trails Association is considering plans for constructing a rock road from Galveston, Tex., to Pembina, N. D., according to a report. The route has been marked through Kansas and Nebraska, and it is stated will connect the forts in the states through which it passes. The road will enter Kansas City from Overland Park, through Penn Valley Park, reaching the Kansas side by way of the Inter-city Viaduct.

Commission Government in Parkersburg, West Virginia, Doing Excellent Work

By F. A. CHURCHILL*

Parkersburg, W. Va., affords a pointed object lesson in support of the oft repeated truism that "a commission form of government for a city is an unqualified success only when the commissioners are the right kind of men and the citizen body is wise enough to back the commission."

Parkersburg's commission as at present organized fulfills the first term of the requirements, and so far the citizens as a body have loyally stood by the commission. Hence public affairs have been conducted upon sound business principles and with high efficiency.


THIRD STREET, LEADING TO COURT SQUARE, PARKERSBURG, W. VA.—PAVED WITH CEMENT GROUTED WIRE-CUT LUG BRICK ON A CONCRETE FOUNDATION.

The sphere of public improvements is, perhaps, the supreme test of a city commission's good judgment and thoroughness, and in no department of public improvement is the possession or lack of these qualities more clearly emphasized than they are in street paving.

The average citizen does not appreciate the importance of thorough inspection and of thorough attention to minute details of construction nor does he understand that the difference between a durable pavement and a poor pavement is often determined by either use of inferior materials or by lax or inefficient inspection.

The highest authorities agree that one of the chief causes of defective paving is penny-wise economy in engineering and inspection services.

Good designs and the most thorough and competent inspection are indispensable. This is true of any type of pavement, and it is especially true of brick. Good construction is obtained by close inspection, and the inspector should always be on the job.

The city commission of Parkersburg is fully cognizant of these facts, and it has had the wisdom and the official integrity of purpose to carry out its plans in conformity with the best engineering practice.

Parkersburg is fortunate in having in Mayor Allen C. Murdoch a conscientious student of municipal problems. He is a successful and prominent citizen, absolutely above suspicion of personal motives, and he has associated with him other men of like stamp in T. L. Higgs, City Engineer; L. N. Pickens, Superintendent of the Department of Public Safety; B. H. Bradford, Superintendent of the Department of Streets and Public Property; E. G. Stephenson, Superintendent of the Department of Water Works and Sewers, and Jno. O. Bullock, Superintendent of the Department of Accounts and Finances.

T. L. Higgs, the city engineer, is an exceptionally energetic, capable and thorough official. From 1909 until May, 1913, he was assistant city engineer. Since 1913 he has been city engineer, and Parkersburg owes much to his ability and efficiency.

Mayor Murdoch and City Engineer Higgs satisfied themselves by study and investigation that brick pavements possessed the requisite of durability and that when properly constructed they entailed low repair and maintenance costs for at least 25 years. The experience of scores of cities justified this conclusion.

About 38,000 yd. of brick pavement were laid in the city last year, many thousands of yards being of wire-cut lug brick. Mr. Higgs has taken the greatest pains with each piece of construction. He has insisted upon the use of an improved type of template for striking the concrete base; he has devised a longitudinal expansion joint running to the bottom of the base; he has designed a framework for the support of a canvas protection for the base on hot days, and in every way he has provided for careful and thorough construction work. Mr. W. C. Perkins, M. Am. Soc. C. E., Chief Engineer for the wire-cut lug brick industry, inspected Mr. Higgs' work in 1916. Mr. Perkins was for several years connected with the New York State Highway Department.

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*Dunn Wire-Cut Lug Brick Co., Conneaut, O.

Mr. Perkins stated: "Mr. Higgs' work was some of the best I have ever seen. The street was absolutely smooth, in perfect condition and the greatest care was used during its construction. His concrete base was the smoothest and the nearest to proper contour and cross section that I have ever seen. The engineering, inspecting and advertisnig expenses, under 5%, were very low. If the cost had been much higher it would have been well expended, if the results had been obtained."

This is high praise from an engineer of the highest standing, one who knows how much depends upon perfection in constructional details.

Thanks to Mayor Murdock and Engineer Higgs, some splendid brick streets exist in Parkersburg.

All the wire-cut lug brick work done in 1916 was on prominent business streets originally paved with small brick laid on sand-gravel foundation. Parkersburg is progressive, and it is taking up the cobbled brick pavement laid on sand-gravel, and is repaving with a concrete foundation and wire-cut lug brick. The accompanying illustration of 3d St., between Ann and Juliana Sts., shows the kind of work being done.

Mayor Murdoch and Engineer Higgs have decided upon cement-sand bed construction for 1917. Market St., 38 ft. wide, from 3d St. to 8th St., and Juliana St., 36 ft. wide, from 3d St. to 8th St., will be paved, the brick being laid on concrete base, 6 in. deep on the heaviest traveled streets and 5 in. deep on the light traffic streets, using 1 in. of cement-sand bed, mixed 1:4.

Mr. Higgs visited Cleveland, O., and other points and inspected cement-sand bed brick pavements and assured himself of the superiority of this type of construction—points which have caused such cities as Baltimore and St. Louis to specify cement-sand bed construction and wire-cut lug brick exclusively for brick pavements, and many other cities to adopt them almost exclusively.

The chief points of merit of the cement-sand bed type of pavement are:

First, it assures greater slab length;

Second, it makes a practically rigid pavement from surface to sub-base;

Third, it eliminates weather hazards during construction;

Fourth, it assures a practically noiseless pavement;

Fifth, it reduces the required depth of the concrete foundation 1 in.;

Sixth, it overcomes the defects in brick pavements which resulted from the use of the sand cushion.

Under the present administration Parkersburg is destined to become noted for the excellence of its modern brick pavements, because Mayor Murdoch and Engineer Higgs are resolved to have the best and to spare no pains in achieving that object. These officials realize that only poor pavements can be constructed if inferior materials be used. They take the only course open to intelligent and honest officials in deciding to use the best materials and to see to it that proper constructional designs and methods are employed.

It is highly creditable to the citizens of Parkersburg that they have loyally supported the mayor and the city engineer in their far-sighted and public spirited policy. The full value of such policy will begin to be appreciated as the years pass and the durability of the pavements is demonstrated.

Bill for a State Highway Department in Wyoming

At the session of the Wyoming Legislature, which has recently closed, an act creating a state highway department was passed.

The act provides for a commission of five to be appointed by the governor, and the selection by this commission of an engineer to be the executive head of the department. The measure empowers the commission to establish state highways and provides funds for their construction and maintenance.

The bill was drawn up by a committee of the Wyoming Good Roads Association.

Columbia River Bridge Opened to the Public

The opening of the great steel bridge over the Columbia River between Vancouver, Wash., and Portland, Ore., on Feb. 14 was attended with ceremonies in which a number of men identified in various ways with the promotion and building of the structure took part. The bridge is 23,000 ft. long, including approaches, and joins the states of Oregon and Washington and forms a link in the Pacific Highway.

At the formal opening the introductory address was made by E. E. Beard, President of the Washington State Press Association. He was followed by Samuel Hill, President of the Pacific Highway Association, who reviewed the different stages of the enterprise, calling especial attention to the parts played by officials and individuals, without whose help the building of the bridge would not have been possible. He said that the last link had been forged in the chain which bound together the Pacific Coast from Vancouver, B. C., to the Mexico line so that it was possible to travel the entire distance over a continuous highway.

At a signal given by Rufus C. Holman, Chairman of the Columbia River Interstate Bridge Commission, a rope placed across the middle of the lift span, symbolizing the barrier which hitherto had existed between the two states, was severed, allowing the thousands of spectators including civic organizations who came by special train and automobile from Portland and elsewhere to cross to either side of the river.

The celebration was continued at the city park in Vancouver, which had declared a holiday. Rufus C. Holman, speaking as chairman of the occasion, referred to the completed structure as demonstrating what could be done by cooperation, and said: "Every act of the commission has been to build a good bridge within the appropriation available and to foster and perpetuate the purpose of the enterprise—to unite southwestern Washington more closely with northwestern Oregon, commercially, industrially and socially." Speeches were made by E. E. Howard, of the engineering firm of Harrington, Howard & Ash, of Kansas City, Mo., designers and builders of the bridge; Governor Withycombe, of Oregon; Mayor H. R. Albee, of Portland; Mayor Milton Evans, of Vancouver; M. E. Carson, Chairman of the Clarke County Board of Commissioners; Henry Crass, former President of the Vancouver Commercial Club; Judge Brooks, of Goldendale; Frank Branch Riley, one of the original promoters of the enterprise; James Stapleton, of Vancouver, and representatives of the leading newspapers of the Northwest, and others. Vancouver, Wash., issued bonds to the amount of $500,000 with which to pay its share of the cost of the bridge, and a toll is charged for the purpose of assisting the municipality in paying the interest on the bonds.

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Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

MARCH 3, 1917.

TRAFFIC REGULATION

At present there are few phases of road work—outside of actual construction and maintenance—that are more pressing than traffic regulation.

The question is before the legislatures of several states and is one that is of vital interest to a large portion of the community. It is also a problem in the solution of which, unfortunately, very little progress has as yet been made. The methods of regulating, taxing and licensing vehicles are out of date and, in some localities at least, are also unfair to the owners and operators of vehicles—especially motor-driven vehicles.

As the use of the motor truck, the tractor and trailer, and the motor bus has increased, there has been manifested a growing tendency on the part of lawmakers to lay upon the owners of these vehicles too large a share of the burden of taxation.

The chief difference between a motor truck, or a tractor and trailer, and a horse-drawn vehicle—so far as the road is concerned—is the motive power. Both are used for the same purposes; both damage the roads; each interferes more or less with the other, and each, in its way is a source of more or less danger. There would seem, therefore, to be no good reason why both should not be taxed and licensed, the amount in each case being determined with reference to the damage done to the roads. The failure to do this can perhaps be partly explained by the tendency to charge all of the wear and tear on the highways to the motor-driven vehicle, in spite of the absurdity of such an attitude. Both kinds of vehicles, of course, wear out the roads, and, as a matter of fact, the difficulty of providing a pavement that will stand up under modern traffic conditions is due in a great measure to the necessity of meeting the different requirements of two inherently different kinds of traffic. It is a comparatively simple matter to build a road that will stand up under horse-drawn traffic or under motor-driven traffic. It is a much more difficult matter to put down a pavement that will stand the strain of the two kinds at the same time.

The reasons that can be cited for the taxation of both kinds of traffic can be used equally well as arguments for the regulation of horse-drawn traffic as well as motor traffic. It should be obvious that congestion and interference are bound to follow the use of the same road by two different classes of vehicles if one class is subject to certain restrictions while the other is wholly, or almost wholly, unrestricted Because horse-drawn vehicles have used the roads longer than have motors they are entitled to no greater rights, and the safety of all users of the roads demand that at least in certain matters both should be subject to the same rules and regulations. For instance, the use of lights on horse-drawn vehicles is quite as necessary, especially for the safety of the occupants of such vehicles, as is the use of lights on automobiles. In the states where such rules have been in force the results have proved their wisdom.

This matter, like many others, is one in which the highway engineer should take an active interest and in which he should have a voice. The determination of the basis of taxation is one requiring the most careful and extensive study as is also the making of rules and regulations for traffic on country roads and city streets. Various interests are working upon the matter and it behooves the engineers to do what they can to bring about some of the reforms that are so patently needed if justice is to be done to all road users.

NEWS NOTES

The Commissioners of Dallas, Texas, at a recent meeting, ordered street paving that will cost more than $200,000, and let contracts for immediate work on thirteen streets.

The County Court of Randolph County, West Virginia, has called a special election for March 10 in the Dry Fork district for the purpose of voting on the issuance of road bonds for $130,000.

Buffalo County, Wisconsin, which is just across the Mississippi River from Winona, Minn., will decide by a vote on April 13 whether or not the county shall issue bonds to the amount of $350,000 for road construction.

The City of Columbus, Ohio, is to have two new bridges of reinforced concrete, one at Broad St. and the other at Mound St., costing $400,000 and $250,000 respectively, according to a report. Braun, Knollman & Fleming, a new firm, are to be the engineers.

The Most Dangerous Grade Crossing in Greater New York which is at Fresh Pond Road and Metropolitan Ave., has been eliminated. Under the law the Long Island Railroad bears half the expense of the work and the other half is borne equally by the city and the state.

Northwestern Michigan Will Construct 300 mi. of state reward roads this year, according to a recent report. The state highway district in that part of the state comprises twenty counties, and it is stated that in Wexford, Manistee, Mason and Mecosta Counties, at least 100 mi. will be built.

A Bill for Creating the Office of County Highway Engineer has been presented to the California Legislature. Its provisions apply to each county in the state. If the bill becomes a law the engineer will occupy about the same position in county work that the state highway engineer occupies in the road affairs of the state.

In a Report of the New York State Highway Commissioner to the Legislature the number of miles of new roads completed during 1916 is given as 667 as compared with 1,073 in 1915. This difference is attributed to the increased cost and scarcity of labor and materials. For the same reasons it is stated that 1917 work under the $50,000,000 bond issue will be materially reduced.

Important Highway Measures Under Consideration in Michigan

By D. A. THOMAS*

Highway legislation is playing a prominent part in the deliberations of Michigan's lawmakers. Four important bills and amendments affecting the State Highway Department and the roads under its charge have been introduced at the present session of the legislature.

A proposed amendment to the highway law doubles the state reward on bituminous concrete, cement concrete and brick roads, and increases the width of road meriting reward from 16 to 20 ft. for the types mentioned, making possible a maximum of $8,400 per mi. in state aid. A section of the amendment compels local road officials to establish an adequate system for the continuous maintenance of state rewarded roads. To further aid in the establishment of such a system the annual repair reward is raised from 2 to 4% of the total state reward previously paid on construction, provided that no mile of road shall be entitled to more than $75 repair reward in any one year.

That this amendment may be more fully understood, it should be said that in Michigan state aid for road building is extended in the form of rewards paid to counties and townships for each mile of road constructed in accordance with the standards of the State Highway Department. There are seven classes of roads on which, under the present laws, rewards varying from $250 to $1,700 per mi. are paid, depending upon the class and width. The reward is doubled if the road lies on a trunk line route. The law also provides that a portion of the appropriations equal to 2% of the total state rewards that have been paid shall each year be credited to a repair fund and paid out pro rata for repairs to state rewarded roads. These payments are not intended to cover the cost of repairs, but are in the nature of rewards to counties or townships for properly maintaining the roads.

The increase in reward on the higher types of roads is an effort to further aid the counties and townships to build roads which will meet the increasing demands of the traffic and to cause the state to share in the cost of construction of these types to more nearly the same extent that it does in the case of the lower classes. A recent average of all trunk line roads showed the proportion of the cost paid by the state to be 43%. This is due to the large mileage of gravel and macadam roads on which the cost paid by the state is frequently much greater than 50%. On roads such as concrete and brick the cost paid by the state is low, being about 15%. The proposed amendment, if it becomes a law, will do much to lessen the extent to which the counties are forced to stress their finances in order to build roads adequate for the traffic and to make the state's share proportionate to the cost on all classes.

Michigan, like many other states, is confronted with the problem of how best to secure the proper maintenance of the highways. The State Highway Department has found it difficult to instill into the minds of the local officials that not only must a road be properly constructed but that it must be competently maintained. As an incentive to keep the roads in repair the reward idea was extended to cover maintenance. The result has not, however, been all that could be desired. By requiring local officials to organize an adequate, efficient and continuous system of maintenance for all state rewarded roads and by doubling the repair reward, it is hoped to effect a radical change for the better.

A second bill introduced gives formal assent to the federal aid road program as required in the government statute, and enables the counties and the state to cooperate with the federal authorities in the construction of roads. The feature of the federal aid bill is the provision made for the allotment of federal and state funds among the counties. A basis for division is secured by dividing the assessed valuation of a county or township by the number of miles of trunk line within its borders. Where the valuation per trunk line mile is $100,000 or less, the local unit pays 25% of the cost, and the state and federal governments the rest. Where the value is between $100,000 and $200,000 the community pays 30%. Between $200,000 and $300,000 the community pays 35%, between $300,000 and $400,000, 40%, and between $400,000 and $500,000, 45%. Above $500,000 the community pays 50%.

It is the desire of the State Highway Department to use the federal aid money to assist in building trunk line roads through the poorer counties which would otherwise be unable to fill the gaps in these important through routes for years to come. Under this plan, the sparsely settled and little developed counties would pay only 25% of the cost of their roads. The more the improvement is needed, and the poorer the community, the more outside aid it will receive.

Every township or county through which run roads constructed under this act must, after building, levy an annual tax equal to 3% of the amount which the community contributed to the cost of building the federal aided road up to, but not exceeding, $100 a mile per year, for maintenance.

The bill provides an annual appropriation of $225,000 for two years to meet the state's share of the cost of the roads and for such other expenses as may be incurred.

A third bill regulates the use and operation of wagons, motor trucks and trailers on the public highways. If enacted, while it will not affect wagons or trucks now in use, it will prevent overloading of all hereafter. For several months shippers, mostly large manufacturers, have found that by using heavy trucks for short hauls overland they could save time and money. The result has been that many of the roads, particularly in the central and southern parts of the state and in the iron and copper mining districts of the upper peninsula, are in bad shape.

The bill will make it unlawful to operate on the highways any vehicle the gross weight of which exceeds 15 tons, farm implements and machinery used in road construction alone excepted. Nor will it be lawful to operate any vehicle which has a gross weight per inch width of tire exceeding 600 lb. This is the section that catches the wagons. A wagon with a 3-in. tire can carry 1,800 lb. to a wheel, or 7,200 lb. altogether.

The limits of sizes, weights and speeds of motor trucks and trailers shown in the accompanying table are established. Some of the provisions of the law are as follows:

No motor truck or trailer shall have a gauge of more than 75 in. measured from center to center of tire, and shall not be more than 96 in. wide over all, nor more than 12 ft. 6 in. in height.

Driving wheels, the tires of which are of metal that may come in contact with the surface of the road or which have a partial contact of the metal with the surface of the road, are not permitted. Chains and other non-skid devices are excepted, but the owner of the truck shall be liable for any damage to the road resulting from their use. This does not prevent the use of steel tires on trailers.

Three-quarters of the gross weight of a truck or trailer and its respective carrying capacity shall be on the rear axle, while the front axle is to carry the remaining one-quarter. In both instances, the wheel loads must be within the limits set forth in the table.

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*Michigan State Highway Department.

During March, April, and May, if by reason of the thawing of frost, or rains, the roads are soft, the maximum carrying capacity of tires on all vehicles shall be limited to one-half the carrying capacity of tires as designated in the act. If at any other time any county or township road commissioner deems it necessary by reason of the soft condition of the roads to put this provision in force, he can do so by the mere posting of notices along the highway.

A bill carrying a total appropriation of $1,300,000 for trunk line rewards and expenses for the 1918 and 1919 fiscal years constitutes the fourth statute referred to. The trunk line act which went into effect in August, 1913, created for Michigan a system of through highways with a possible maximum of 4,785 mi. of road, so laid out as to serve the state as a whole. To encourage the construction of trunk line roads, the state not only pays double reward but makes all surveys and plans and constructs bridges over 30 ft. in span on trunk line routes. During the past three and one-half years 871 mi. of trunk line roads have been built. The proposed appropriation is a $400,000 increase over the total for the two preceding years, but the increase in the mileage constructed each year under the trunk line act has been such that an increase in the appropriations each year is taken as a matter of course.

SCHEDULE FOR THE REGULATION OF MOTOR TRUCKS AND TRAILERS UPON THE HIGHWAYS.
Table for a Wheel 32 Inches in Diameter.

Size of Tire in Inches	Single Tire		Double Tire	
	Maximum Wheel Load In Pounds	Miles Per Hour	Maximum Wheel Load In Pounds	Miles Per Hour
2	700	20	1,400	18
2½	900	20	1,800	18
3	1,200	20	2,400	18
3½	1,600	20	3,200	16
4	1,900	18	3,800	14
5	2,200	16	4.400	13
6	2,700	14	5,400	12
7	3,200	12	6,400	10

For a 34-inch wheel multiply the above maximum wheel load by 1.1
For a 36-inch wheel multiply the aboxe maximum wheel load by 1.2
For a 38 inch wheel multiply the above maximum wheel load by 1.3
For a 40-inch wheel multiply the above maximum wheel load by 1.4
For a 42-inch wheel multiply the above maximum wheel load by 1.5
For a 44-inch wheel multiply the aboxe maximum wheel load by 1.6

Vermilion County, Illinois, Lets Large Cement Contracts

Following the report of the special road committee regarding cement for road construction in Vermilion County, Illinois, for the year of 1917, the Board of Supervisors at its February meeting adopted a resolution accepting bids of the Atlas, Continental and Universal companies for 190,000 bbl., as follows: Atlas, 49,055 bbl., $100,072.20; Continental, 25,000 bbl., $51,850; Universal, 115,945 bbl., $392,508.07.

Recommended Width of Wagon Tires

Recommendations for the width of tires for wagons of various capacities have recently been made by E. B. McCormick, Chief of the Division of Rural Engineering, Office of Public Roads and Rural Engineering, U. S. Department of Agriculture. The recommendations, which are embodied in Circular 72 of the Department of Agriculture, are as follows:

Type of Wagon	Gross Weight load (lb.)	Width of tire (in.)
1-horse wagon	2,000	2
Light 2-horse wagon	3.500	2½
Medium 2-horse wagon	4,500	3
Standard 2-horse wagon	6,800	4
Heavy 2-horse wagon	7,500	5

These recommendations, according to the circular, were based upon two factors: "(1) The unit weight for width of tire commonly used for road rollers and (2) the results secured from a large series of traction tests conducted by the Office of Public Roads and Rural Engineering, extending over several years and made in widely scattered localities throughout the United States." In discussing his recommendations, Mr. McCormick states that while in the past there has been a wide variation in the sizes and types of wagons made, and while to a certain extent this condition still exists, it is believed that the five sizes of wagons noted in the table "will be sufficient to meet all the needs of farming operations and all general work except the heaviest trucking and certain specialized hauling, which is likely to be confined to city pavements."

Road and Bridge Appropriations in Cook County, Illinois

The Commissioners of Cook County, Illinois, have appropriated nearly $2,000,000 for road and bridge construction and maintenance during 1917.

Of the total, $48,689.38 is to be spent on bridges, $51,359.69 for aiding in the construction of roads in the county, $1,630,891.33 for county road construction, and $152,129 for building state aid roads. To the latter the state must contribute an equal amount, thus bringing the total appropriation to more than $2,000,000.

NEWS NOTES

Berrien County, Michigan, is to build a brick highway from Niles to the Michigan-Indiana state line, according to a recent report.

The Board of Supervisors of Clay County, Iowa, has let the contract for grading 63 mi. of highway to the Edward Peterson Co. of Omaha, Neb.

About 60 mi. of Hard Road will be built in McDonough County, Illinois, if the bond issue of $60,000,000 which is proposed for road improvement in the state, is passed.

Residents of Cleveland Heights, San Diego, Cal., have filed a petition requesting that a number of streets in that section be paved with concrete with a ½-in. asphaltic wearing surface.

Four Highways in Noble County, Indiana, are to be improved for a distance of 3 mi. each, at an estimated cost of $192,000. Bids for brick construction will be received by the board of county commissioners at Albion, Indiana, in March, according to a recent report.

The Dearborn Construction Co., of Waterloo, Ia. has been awarded the contract for paving 23 blocks in Traer, Ia., the type of construction to be Texaco asphaltic concrete at a cost of about $60,000. The work will commence in May and is to be completed by September, according to a report.

The Highway Between Fort Worth and El Paso, Texas, a distance of more than 600 mi., will be improved within the next 18 months, if the plans of the Fort Worth-El Paso Highway Association are carried to completion. The different counties along the route of the proposed highway have manifested the deepest interest in the project and have given assurance that each would do its share of the work.

MEETINGS

Calendar of Coming Meetings

March 5-6—National Paving Brick Manufacturers' Association—Annual convention, Hotel McAlpin, New York, N. Y. Secretary, Will P. Blair, Cleveland, Ohio.

March 5-7—American Ceramic Society—Annual meeting, Hotel Astor, New York, N. Y. Secretary, Edward Orton, Columbus, O.

March 14.—Vermont Society of Engineers—Meeting, Hotel Vermont, Burlington, Vt. Secretary, Geo. A. Reed, Montpelier, Vt.

April 10-14.—Dominion Good Roads Association—Fourth Canadian and International Good Roads Congress, Horticultural Building, Ottawa, Ont., Can. Secretary, Geo. A. McNamee, 909 New Birks Building, Montreal, P. Q.

April 17-20.—U. S. Good Roads Association.—Fifth annual convention, Birmingham, Ala. Secretary, J. A. Rountree, 1021 Brown Marx Building, Birmingham, Ala

New York State Road Builders' Association

At the election of the New York State Road Builders' Association on Feb. 19, officers for the coming year were elected as follows:

President, John H. Gordon, Albany, N. Y.; Vice President, C. J. Hendrickson, Syracuse, N. Y.; Treasurer, William G. Fox, Saratoga Springs, N. Y.; Secretary, J. W. Manion, Albany, N. Y.

Fred E. Ellis, of Melrose, Mass., and W. T. Thayer of Chateaugay, N. Y., were elected trustees to serve three-year terms.

Citizens Street Traffic Committee of Greater New York

The Citizens' Street Traffic Committee of Greater New York held a dinner meeting at the Automobile Club of America on Thursday evening, March 1. The subjects for consideration were: 1—Resolutions pertaining to recommendations with reference to cooperation in snow removal submitted by Commissioner Fetherston; 2—Resolutions pertaining to recommendations with regard to administration and regulations covering openings in pavements; 3—Investigations which might be considered by the Traffic Commission to be appointed by the Mayor of New York.

Fourth Canadian and International Good Roads Congress

The Fourth Canadian and International Good Roads Congress will be held under the direction of the Dominion Good Roads Association, in the Horticultural Building, Lansdowne Park, Ottawa, Ont., Can., April 10 to 14, inclusive. The Horticultural Building is on Banks Street and has excellent car service from the center of the city, a 12-minute ride, while adjoining freight sidings will prove a great convenience to the exhibitors at the annual show of road machinery, materials and accessories, held in conjunction with the congress. The building is spacious and well lighted, and has ample accommodations for both convention and exhibition purposes.

Among topics which will be discussed by road experts from both Canada and the United States are finance, legislation, drainage, foundations, wearing surfaces, maintenance and permanent types of construction. In addition there will be special papers on gravel roads, county organization and the defining of the regulations under which municipalities may avail themselves of the road legislation put in force by the various provinces of Canada. Stress will be laid upon the present day needs of the different sections of the country.

Invitations are being sent to boards of trade, good roads associations, automobile clubs, manufacturers' associations, engineering societies and others.

According to J. A. McNeil, Publicity Representative of the congress, 909 New Birks Building, Montreal, P. Q., the outlook for highway improvement in Canada is very encouraging. Quebec has recently appropriated another $5,000,000 for road making, and has adopted legislation providing for the maintenance of roads already built. In Ontario important legislation is expected at the current session of the provincial parliament. Nova Scotia and New Brunswick are planning highway policies, and progress is being made in other provinces. It is understood that the dominion government intends voting $10,000,000 for highway improvement.

A meeting of representatives of fifty marked trail associations and motor clubs of Illinois will be held at Springfield, March 10. The purpose of the meeting is to organize a state federation. The arrangements are in charge of Clarence J. Root, of Springfield.

Acceptances of invitations to attend the fifth annual meeting of the United States Good Roads Association at Birmingham, Ala., April 17-21, have been received from eight governors, according to J. A. Rountree, Secretary of the association. The governors who have accepted are Henderson of Alabama, Brough of Arkansas, Bilbo of Mississippi, Gardner of Missouri, Catts of Florida, Manning of South Carolina, Stanley of Kentucky and Harris of Georgia.

PUBLICATIONS

WIDTH OF WAGON TIRES RECOMMENDED FOR LOADS OF VARYING MAGNITUDES ON EARTH AND GRAVEL ROADS. Bv E. B. McCormick, Chief, Division of Rural Engineering, Office of Public Roads and Rural Engineering, U. S. Department of Agriculture. Circular No. 72, U. S. Department of Agriculture. Paper 6x9 in., 6 pp.

This circular comprises recommendations for the width of wagon tires based upon two factors: (1) the unit weight for width of tire commonly used for road rollers, and (2) the results secured from a series of traction tests conducted by the Office of Public Roads and Rural Engineering. Besides a discussion of the two factors, and the recommendations made, the circular contains a number of curves showing the results of traction tests and a curve showing the relation between the decrease of unit draft and the decrease of weight per inch width of tire.

COLORIMETRIC TEST FOR ORGANIC IMPURITIES IN SANDS. By Duff A. Abrams, Professor in Charge of Laboratory, and Oscar E. Harder, Chemist, Structural Materials Laboratory, Lewis Institute, Chicago, Ill. Circular No. 1 of the Structural Materials Laboratory conducted jointly by the Portland Cement Association and the Lewis Institute. Paper 6x9 in., 8 pp. and covers.

Included in this circular, which is the first issued by the laboratory operated jointly by the Portland Cement Association and the Lewis Institute, are general discussions of impurities in sands and the colorimetric test, a description of the method of conducting field tests and laboratory tests, the conclusions of investigators and other data. The work was carried out in cooperation with Committee C-9 on Concrete and Concrete Aggregates, of the American Society for Testing Materials.

PERSONAL NOTES

Aaron Pancoast has been appointed County Engineer of Bexar County, Texas, with headquarters at San Antonio.

Charles Boone, formerly engaged in the contracting business in Iowa, has been appointed County Engineer of Hancock County, Indiana.

Frederick R. Hazard, President of the Solvay Process Co., died at Syracuse, N. Y., on Tuesday, Feb. 27. He became identified with this company shortly after it was founded in 1884, and was a director in a number of industrial corporations. In 1881 he received a bachelor's degree from Brown University, and a master's degree in 1884.

R. I. Waldron has been made general manager of the Southern Paving Co., of Dallas, Texas, taking the place of Lester Levy, resigned.

Walter Skelton was recently appointed City Engineer of Salem, Oregon, instead of B. W. Macy, as stated in the issue of Feb. 3. Mr. Macy is City Attorney for Salem.

Edward W. Dahl, who became County Engineer of Yuma County, Arizona, in the fall of 1916, and who was formerly with the U. S. Reclamation Service, has been appointed City Engineer of Yuma, Ariz.

Eugene W. Stern, Chief Engineer of Highways of the Borough of Manhattan, New York, N. Y., has been commissioned by President Wilson Major in the Engineer Officers' Reserve Corps, U. S. Army.

C. E. Van Valkenberg has been made City Engineer of Fresno, Cal., succeeding B. E. Cronkite, who has been placed in charge of sewer construction on the $500,000 system for which contracts have been let.

EQUIPMENT — TRADE — MATERIALS

Taking Up and Cleaning Brick Paving Blocks by Compressed Air

An interesting use of a portable air compressor outfit is reported from Troy, N. Y., where the Department of Public Works has used a portable air compressor operated by a gasoline engine for taking up and cleaning brick paving blocks.

The equipment used consisted of a 15-hp. Sullivan Class WK-3 single-stage compressor, a Sullivan DA-15, 25-lb. plug drill and a Sullivan DB-13 hand bushing tool equipped with bits similar to a cold chisel, with the necessary hose connections. The larger of the two tools is used for tearing up the bricks and the smaller one for removing from them the old grout. With the plug drill, it is stated, one man can remove 4 sq. ft. of pavement in 15 or 20 minutes, taking the bricks up one at a time or several at a time as desired. The compressor outfit, the operation of taking up the bricks and the operation of cleaning them are shown in the accompanying illustration.

AT LEFT: REMOVING BRICK FROM PAVEMENT WITH PLUG DRILL—AT CENTER: COMPRESSOR OUTFIT—AT RIGHT: REMOVING OLD GROUT FROM BRICKS WITH BUSHING TOOL.

Before the purchase of the outfit in 1913 the cost of removing and cleaning the bricks by hand amounted to about $24 a thousand, a crew of 10 men being able to handle about 1,000 bricks a day. The total cost of operating the compressor and drill outfit was as follows:

One compressor engineer	$3.00
7 gal. gasoline, at 18 cts.	1.26
4 operators, at $1.85	7.40
Lubricating oil	.25
Total cost per day	$11.91

This cost, which does not include interest or depreciation, brings the cost of the work to about $5.96 per thousand bricks, an estimated day's work being about 2,000 bricks in 8 hours. In the following table are shown the number of bricks cleaned each year since the machine has been in use and the estimated saving made by the machine:

Year.	Number of bricks.	Saving.
1913	229,000	$4,122
1914	82,200	1,480
1915	356,000	6,400
1916	100,000 (estimated)	1,800
	767,200	$13,802

The outfit was made by the Sullivan Machinery Co., of Chicago, Ill.

Gramm-Bernstein Selling Plans

The Gramm-Bernstein Motor Truck Co., of Lima, Ohio, has entered into an arrangement with R. E. Taylor Corporation, of New York City, whereby the latter assumes control of the sale of the Gramm-Bernstein trucks in the states of New York, Connecticut, Rhode Island, Massachusetts, New

Hampshire, Maine, Vermont, New Jersey, Pennsylvania, Delaware and Maryland and in the District of Columbia.

A new administration building, additional factory facilities and new equipment at Lima are included in the plans of the company as a result of the recent increase in its capitalization from $500,000 to $4,000,000. The executive offices of the Taylor Corporation have been established in the Brokaw Building, Broadway at 42nd St., New York, N. Y.

Convention of the Trussed Concrete Steel Company

The second annual convention of the Trussed Concrete Steel Co. was held at the plant of the company at Youngstown, Ohio, Jan. 23 to 26, inclusive. Nearly two hundred branch managers and representatives from every section of the country were in attendance.

The program of the business sessions consisted of the reading of papers and their discussion, in which new developments and improvements were presented to the men as well as a review of the work of the past year and prospects for the future. The entertainment features of the convention were well arranged, and included an evening at the Hippodrome Theater where special acts and features were put on expressly for the delegates, and a county fair given at tho Hotel Ohio, the various exhibits representing many original features. At the annual banquet on Thursday evening, Jan. 25, motion pictures, original plays, etc., were substituted for the usual formal speeches.

Notes.

The Athens Brick Company of Athens, O., and the C. P. Mayer Company of Bridgeville, Pa., have become licensees of the Dunn Wire-Cut-Lug Brick Co. of Conneaut, O.. The addition of these two firms brings the number of companies included to 43 and the number of plants to 68.

A charter of incorporation was granted at Harrisburg, Pa., on Tuesday, Jan. 30, to McInerney & McNeal, Inc., contractors of Easton, Pa., capital $10,000. The incorporators are Frank McInerney, John McNeal and A. H. Herman. The company will do a general contracting business, specializing in road construction of various types.

Extension of bituminous road building into country districts, remote from permanent plants, has created the need for easily portable asphalt mixing plants. It is to meet this need that the Iroquois Works of The Barber Asphalt Paving Comapny has designed several types of plants, ranging from 800 sq. yds. to much larger capacity. These plants and their operation are described in an illustrated bulletin (No. 2A) just issued by the Iroquois Works, Buffalo, N. Y.

The Walter A. Zelnicker Supply Co. of St. Louis, Mo., has purchased the abandoned Idaho Southern Railroad between Gooding and Jerome, Idaho, and the Milner & North Side Railroad between Milner and Oakley, Idaho. The two roads have a total length of about 50 mi. and were built only a few years ago by Pittsburgh capital. It is understood that the purchaser will dismantle the roads and sell the rails and other equipment, which are practically new.

A four-page folder, 9x12 in. in size, describing the Austin tandem motor roller has recently been gotten out by the Austin Manufacturing Co., Chicago, Ill. The folder contains a brief description of the tandem motor roller made by the company with a table of general dimensions of the 5, 6, 7, and 8-ton sizes. The first page carries a large half-tone reproduction of a photograph of the complete machine and on the two inside pages are shown other views of the machine and of its different parts.

Announcement has been made of the consolidation of the McGraw Publishing Co., Inc., and the Hill Publishing Co., both of New York, N. Y., as the McGraw-Hill Publishing Co., Inc. The new company acquires all the properties and interests of the two constituent firms including the following publications: "Electrical World," "Electrical Railway Journal," "Electrical Merchandising," "Engineering Record," "Metallurgical and Chemical Engineering," "The Contractor," "American Machinist," "Power," "Engineering News," "Engineering and Mining Journal," and "Coal Age." It is also announced that the "Engineering News" and the "Engineering Record" will be consolidated under the name "Engineering News-Record," Charles Whiting Baker, present Editor of the "Engineering News," remaining as Editor-in-Chief of the "News-Record." The officers of the new corporation will be James H. McGraw, President, Arthur J. Baldwin, Vice President and Treasurer, and E. J. Mehren, Vice President and General Manager.

LETTER TO THE EDITOR

Equipment for Testing Non-Bituminous Road Materials

Editor "Good Roads":

I am often asked what comprises a simple laboratory for testing non-bituminous materials. A friend of mine has given me the following list of materials.

Can any of your readers suggest additions or improvements—naming cost of items added?

Seattle, Washington. SAMUEL HILL.

[The list referred to by Mr. Hill is printed below. Suggestions from readers will be welcomed.—Ed.]

Equipment for a Non-Bituminous Road Materials Testing Laboratory

Quantity	Description
1	Deval abrasion machine, 4 cylinders
1	Ball mill
1	2-hp., 3-phase, 220-volt induction motor
1	Dorrey hardness machine
1	Impact machine for testing toughness of rocks with with 2-kg. hammer
1	¼-hp., 220-volt, a. c. motor for impact machine
1	Cementation test machine with 1/20-hp. motor.
1	Drill press with 1-in. diamond core drill
1	Diamond saw with polishing plate
1	Extra saw
5	Lbs. No. 120 carborundum
1	Small jaw crusher
1	Scale, capacity 5 kg. and sensitive to 0.5 gm.
1	Scale, capacity 100 gm. and sensitive to 0.1 gm.
1	Balance, capacity 100 gm. and sensitive to 0.01 gm.
1	Large drying oven
1	Small drying oven with temperature regulating device
1	10-in. desiccator with calcium chloride
1	Millimeter scale
1	Doz. pint jars with metal screw caps
1	Doz. 3-qt. enameled iron pans
1	100 c.c. graduate
1	100 c.c. beaker
1	Set Morse nestable sieves Nos. 10, 20, 30, 40 50, 80, 100, 200, with cover and pan
1	16-in. sieve reinforced, with square opening 1/16 in. in size
1	2½-in. hole stone screen
1	1½-in. hole stone screen
1	½-in. hole stone screen
100	Burlap bags about 17 in. square
500	Blank tags
1	50-lb. anvil
1	4-lb. sledge hammer
1	3-lb. double-faced stone hammer
1	1½-in. single-faced stone hammer
1	6-in. scoop
1	Bbl. quartz sand between No. 30 and No. 40 sieves
1	Bale of waste
1	Waste can
1	Oil can and motor oil
	Maximum cost above equipment ————

The Election in White County, Illinois, which was to have been held March 14 for the purpose of voting on a $252,000 bond issue, has been postponed indefinitely, the legality of having the election at the time stated being in question.

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A Bridge Failure Due to Lack of Engineering

By JOHN B. WOODS

An example of what may be expected when a structure is built of even the best of materials but without engineering aid in the preparation of plans or in the work of construction is furnished by the concrete bridge shown in the accompanying illustration.

The structure is situated in a certain county in one of the states in the Mississippi Valley. The county in question has recently awakened to the need of good roads and has commenced the improvement of its highways, building the necessary culverts and, at the wider stream crossings, putting in single-span concrete beam or girder bridges. The bridge which failed was the longest undertaken and because of its length, the county official in charge of road work decided to modify the usual method of construction by adopting an arch span.

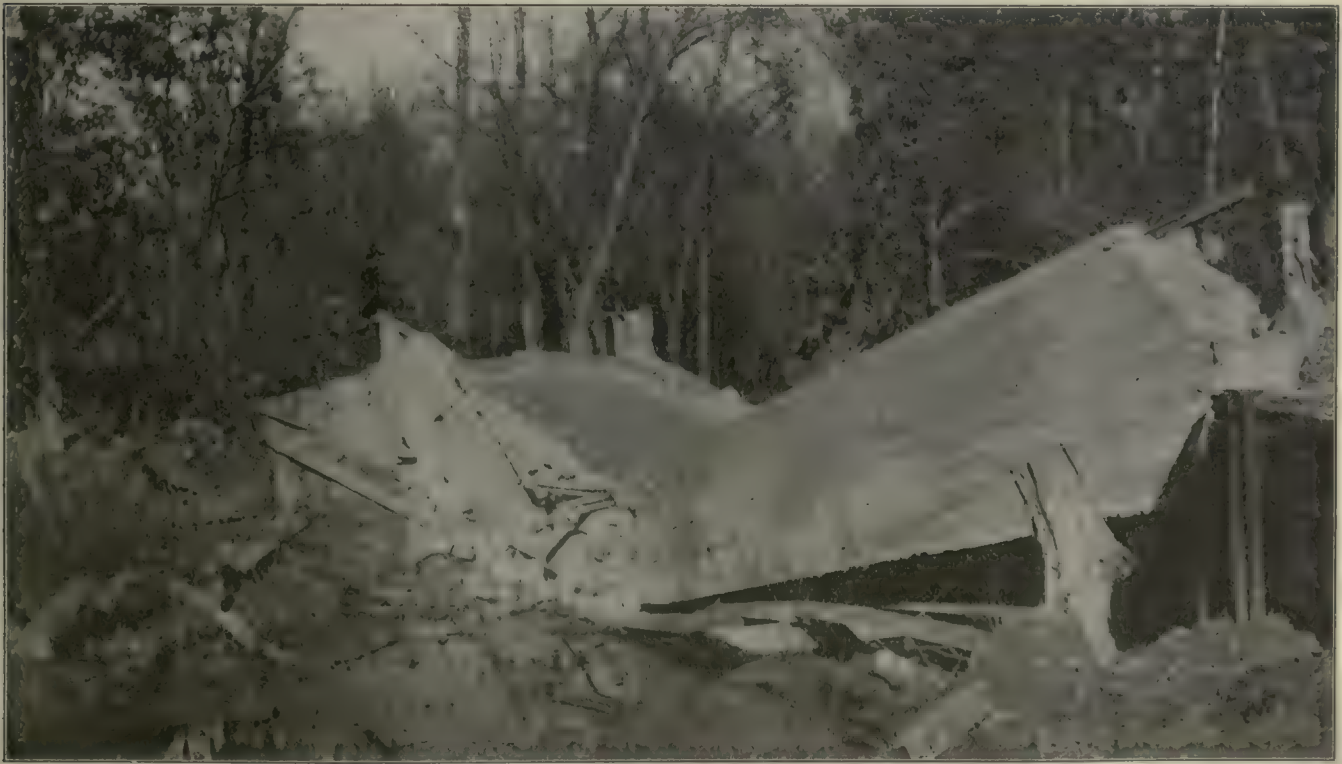
The work was done under the general supervision of this official with no plans for the guidance of the men other than the official's mental picture of what he wanted. Unskilled day labor was employed and the force was directed by a man of little actual experience who made no pretense to technical skill.

The bridge was intended to have a clear span of 50 ft. and to consist of a reinforced concrete arch with a rise of 3 ft. and a crown thickness of 2 ft. 6 in. It was supported at the ends by concrete abutments 2 ft. thick at the level of the top of the arch and 3 ft. at the bottom, and was reinforced with 40 and 60-lb. railroad irons and fence wire. Wing walls about 1 ft. in thickness were provided and on top were parapets 3 ft. high and about 10 in. thick. The roadway was 14 ft. wide in the clear.

As labor was scarce and not dependable, the concrete was poured at several different times so that the concrete in portions of the structure had set before other parts were poured. In addition the concrete was unusually lean.

When the last run of concrete appeared to have set the forms were removed and when the center support, which rested upon a mudsill in the stream bed, was taken away the structure fell into the creek, breaking in the center and pushing the abutments backward.

The bridge cost about $600 and is a total loss. In addition, it will cost about $100, it is estimated, to remove the debris.



WRECK OF A 50-FT. SPAN REINFORCED CONCRETE ARCH BRIDGE BUILT WITHOUT ENGINEERING SERVICES IN PLANNING OR CONSTRUCTION.

Earth Road Construction and Maintenance*

By J. H. MULLEN†

Earth road construction is a subject that is generally given perfunctory consideration at every road meeting. After reiterating a few well known points, such as the necessity for drainage, the delegates pass on to the more interesting discussion of high class and expensive surfacing. I think it is high time that we got down to brass tacks in this matter and would like to see the road authorities make a careful study of the earth road problem and give some time to it.

You will pardon me for again reminding you that 80% of our roads must of necessity be earth roads for some time to come and I maintain that they properly should remain as earth roads, for the reason that the traffic imposed upon them does not warrant an expensive surface. But let us see that these roads are substantially and properly built, as well as the other earth roads which will later be surfaced. This is not merely for the reason that such work is the only permanent part of road work and will be the foundation for later improvement to the surface; but more important, that this work, if properly directed will improve the thousands of miles of feeders which are actually the limiting factors in hauling the great tonnage of farm produce. This problem of hauling the farm tonnage is being lost sight of to a great extent in the apparently more pressing need of building the main arterial highways, but as the veins are to the arteries in our physical make-up, so are the feeders to the arterial highways. Each is dependent upon the other, and by working the two together we may achieve united support to the systematic organization for road improvement, and thereby accomplish the desired result—good roads.

Most road authorities agree upon the necessity for proper locations, complete drainage, etc. But do we get it? I have gone over many jobs put through by men whom I have heard talk at great length on this subject and found light, undrained ditches, rolling profile, and bad turns, where there was no necessity for such conditions, and in explanation was informed that "they" insisted upon putting the money into surfacing. I believe that fear of this mythical "they"—which means the uninformed or misinformed portion of the public—has greatly retarded road development, and it is up to the people who know and are paid for knowing, to bring about a better understanding of the business of road building. How many county road systems are laid out upon a systematic basis? Very few I would say, and this in the face of the fact that road work constitutes the greatest single activity in any community. The first step to be taken by a governing body, such as a county board, is to employ a road engineer and make a survey of the road situation—not an instrument survey, but a study of the transportation problems in the county—and to do this successfully the board must forget district lines and disregard personal pleas. The determination as to type of road, which road shall be constructed first, and the amount of funds to be raised, either by tax levy or bond issue, should be based upon definite and positive data showing the necessities of the community and the probable use to which the roads will be put. When these determinations are made the engineer should be authorized to plan the work and carry it through, the board acting merely in an advisory capacity and not taking any active part in the work, but holding the engineer responsible for all details of plan and execution. With the adoption of such a policy and the exercise of good judgment the county may be sure of making progress.

The first point to take into consideration in the detail planning of a road system is location. Too many of our important roads are poorly located, in many cases on account of the tendency to follow the first trail, but usually because of holding strictly to subdivision lines. In gently rolling and well drained country it is probably better to follow the section lines, but where heavy grades are encountered or other bad topographical conditions exist, a complete survey should be made and a location determined upon which will provide the most economical and satisfactory road for all time, without regard to property lines. Factors in determining locations are, volume and direction of traffic, limiting grades, possibilities for adequate drainage, and safety. As to gradient, a maximum of 5% should be located if possible. Sharp turns should be avoided, and in all cases there should be a clear sight distance of 200 ft., and a radius of not less than 70 ft. Location and grades determine the limitations of all future travel and should be studied carefully.

To have any degree of success with an earth road it must be completely drained, and this means wide, deep ditches and offtakes, the location and grades of which must be determined by survey, for the eye cannot be trusted in laying out this work. It is the moisture drawn upward through the soil that does the most damage to a road and for that reason the side ditches must be carried to good outlets. In some instances tiling is necessary. The most common neglect of drainage is found where grades are built up by borrowing material from the sides with blade graders. On such work the profile of the ditch conforms to the contour of the ground, leaving water in the depressions and so saturating the grade. On nearly every blade grader job it is necessary to provide extra work to take care of the drainage. In this connection I wish to say that blade graders are essential to both construction and maintenance, and will move material from ditches to roadway at less cost than any other method. But there is always a tendency when using these matchines to make the work too light, and the requirements for drainage are overlooked in the desire to cover a large mileage at a low cost. After having a few years' maintenance experience an engineer will always insist upon doing heavy, substantial earth construction, for in most cases the first work laid out has to be rebuilt on account of being too light, and frequently a surfacing has been applied which is lost through the poor foundation work or has to be thrown away due to the necessity for rebuilding the grade. This is one of the big points in earth road building and is a constant source of controversy, through lack of study by some of the road officials and the extravagant claims made by grader salesmen that their machines will build roads under all conditions at a cost of $100 per mi. or less.

One very important point in building an earth road is to eliminate all vegetable matter from the upper 1½ ft. of grade. Sods should be wasted or placed in the bottom of fills, for such vegetable matter only serves to act as a sponge.

The rolling of an earth road has been demonstrated as being advantageous, particularly by the use of heavy tractors hauling graders. We find in this work that it is not uncommon to obtain compression of the soil amounting to from 30 to 50% on light work, which means better bearing power and less damage by rains. An important point in road specifications, particularly on cut and fill work, is to require what we call "construction dragging," which means that a road shall be dragged constanty during the building of grades and that the roadbed shall be kept smooth at all times during construction. In that manner chuck holes and ruts are prevented on new work and the road is turned over to the maintenance crew in a finished condition.

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*Paper presented at the Northwestern Road Congress.

†[illegible] Engineer of Roads, Minnesota State Highway Commission.

The cross section for earth roads should not be rigidly standardized. On the contrary, it is best to designate the width of roadway for the traffic to be served and allow the slopes and crown to be governed by soil conditions. It is, however, a good plan to have standards as guides for typical conditions. It was formerly the rule to build a high crown on an earth road in order to shed water, but now that maintenance systems are being established we find that a light crown on substantial earth construction is best, for this permits intensive dragging which results in the building up of a puddled hard crust more resistant to traffic and impervious to water. The minimum width of roadway should be 20 ft. and on main lines 24 ft., but for safety on fills it is a good plan to have increases of width based upon height of embankment, as for instance: 4-ft. fill, 24-ft. roadway; 8-ft. fill, 26-ft. road, etc. On low fills, the embankment should carry a slope of not more than 3 to 1 into side ditches.

It will be found that the dressing and trimming of slopes and lining up of fills will add greatly to the value of the work in the estimation of the public, and not only that, but the future maintenance will conform with the construction lines, therefore the road shoulders should be built true to line. Experience proves that the draggers will follow any weaving of the shoulders and that eventually the traveled track will take a winding course corresponding with or greater than the defects in shoulder alignment. The hand finishing of back slopes and ditches will more than pay for itself in the decreased cost of maintenance, for a ragged slope will wash and cut out, causing heavy maintenance in the ditches, while a trimmed slope is less likely to do so. We have had good success by placing layers of brush at each 2 or 3-ft. lift on heavy, sliding, clay fills. This brush is laid of sufficient length to reach beyond the line of frost and prevents the usual breaking down of fills made from such material. The ends of the brush are allowed to project slightly to hold the manure which is spread over the slope, grass seed being planted to form a sod. It is poor economy to build a wide embankment and then allow the moisture or frost action to decrease the effective width by several feet. It would be better to slightly decrease the width and use the saving in cost to protect what is built. This can be accomplished by sodding sand or ordinary clay slopes or using the previously described methods on sliding clay.

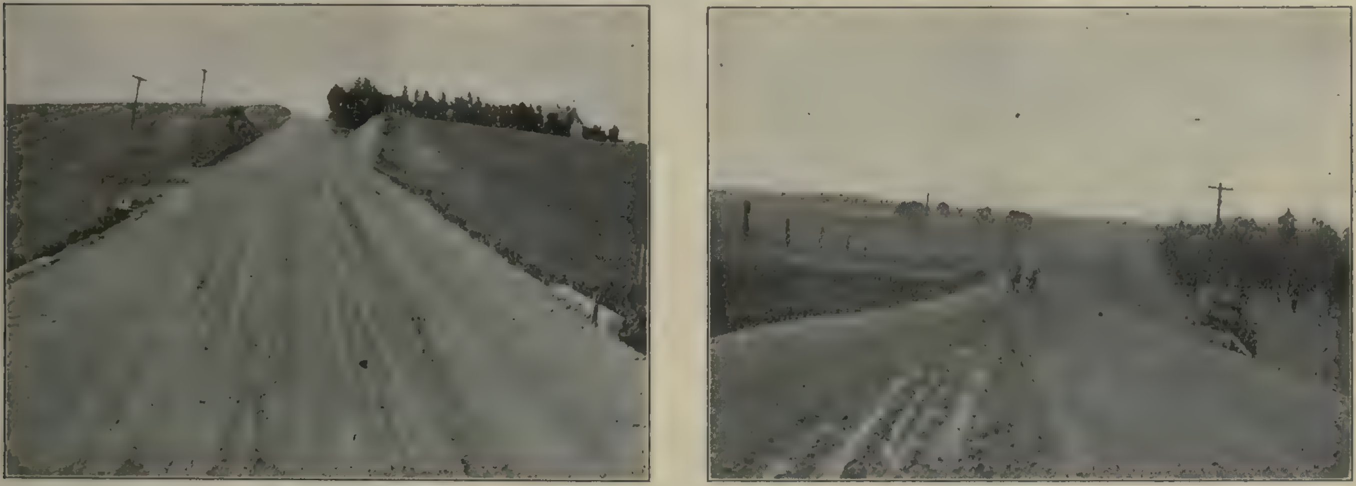
As to whether road work shall be done by contract or by county forces is a question. Our experience has shown that light grading and blade grader work can be done more economically by county forces; but in heavy work requiring considerable equipment and on which measurements can be more accurately made, it is better to let the work by contract.

To secure satisfactory results, earth road construction should be planned and conducted in a substantial way and always with a view to future maintenance.

Any road construction is without permanent value unless an adequate system of maintenance is established. This is especially pertinent to the earth road, and as a matter of fact, the earth road is made a satisfactory highway only through maintenance. It is also true that the poor reputation attached to earth roads is due largely to the lack of care in their upkeep.

Road maintenance is a business in itself—comes very near to being a profession. While methods may differ in various localities it is necessary in all cases to organize the work along definite lines, with responsibility placed and authority given to carry on the work. While the rule holds good in nearly all work it is especially important on maintenance that a line of personal responsibility be established.

The function of the county board is to employ the proper kind of a man as superintendent of the work—a highway engineer or competent road builder if possible—and with his assistance go over the problem and determine upon the system to follow, estimating the probable cost; then provide for and set aside the necessary funds and authorize the maintenance superintendent to proceed.


Faribault County. Fillmore County.

TYPICAL EARTH ROADS IN TWO MINNESOTA COUNTIES.

The details of maintenance work are so various and so dependent upon local conditions that it is difficult to lay down a set of requirements, which will cover the situation in a whole state. In the first place, the road must be made ready for maintenance and, in fact, this is considered as a part of the maintenance work. The use of a light grader in opening up drainage and bringing back the crown of a road is almost necessary each spring and on most roads several times during the season.

Crews should be sent out in the late fall and early spring to open culverts and lines of drainage, and general repairs to the grades must be made before defects become serious. A great deal of expense due to washouts may be avoided by adopting some method of opening frozen culverts. For instance, the placing of a shovelful of salt in the ice at the head of a culvert will force an opening, or a small pipe plugged at both ends may be placed in the culvert in the fall and allowed to freeze in, then in the spring the ends are opened and water allowed to run through, thereby starting a channel. In some cases it is necessary to have two culverts, one of which is closed during the winter.

We are all agreed that dragging is the principal feature of earth road maintenance. The surface of a road which has been traveled for some time becomes consolidated by what may be called a puddling action and if the road is kept crowned and smooth this surface will permit the water to run off before damaging the roadbed. The constant use of a road drag will, by spreading at frequent intervals a thin layer of puddled earth over the road surface, tend to build up an impervious crust which will resist the action of moisture and abrasion of vehicles. It is, however, the management of the dragging which makes or breaks the effectiveness of the maintenance system. The superintendent must enter into contract for the county with residents along the road to drag certain definite sections after each rain and whenever ordered by him. These sections may vary from 1 to 3 mi. for team haul and up to 10 mi. or more with a tractor. In contracting this work a price per mile for dragging and per hour for extra work, such as clearing ditches, etc., is agreed upon and it is stipulated that the price of the first few draggings will be retained until the end of the season and any neglect to drag when necessary will be compensated for by deduction from the retained percentage of an amount which would otherwise have been paid to the contractor for the work which should have been done. It is manifestly impossible to closely check this work, but by having a system of reporting by post card immediately after each dragging and using these reports as a basis for making monthy payments, it is found that few errors occur, and the superintendent is generally given considerable voluntary assistance and information by those using the roads. The telephone is a valuable adjunct to this work and it is found that after the work is well under way the superintendent can select the best man in each locality and entrust him with the authority to call out the drags by telephone when necessary; and he can also save much in telephone charges by having such men spotted to distribute hurry-up orders to the draggers.

The kind of drag to use has been quite a study, and although many of the so-called log type are used it has been demonstrated that the light graders and road planers are much better, for the reason that the ordinary drag does not level the road longitudinally, but on the contrary tends to gouge out depressions, while an implement similar to the Minnesota road planer will level the road longitudinally as well as transversely and will reduce the waviness found so objectionable on many highways.

In conclusion I wish to emphasize the necessity for organizing the maintenance work systematically. Get the men to take pride in their work; hold them responsible, and get them together at least once a year for instructions and exchange of ideas.

The Industrial Railway for Transporting Materials in Road Work[*]

By A. D. THOMPSON[†]

The employment of industrial railways for transporting road materials is the logical application of a hauling system used for many years in mines, industrial plants and railroad construction. The track for these railways is usually 24-in. gauge, with 16- or 20-lb. rails and steel or wood ties. The built-up track with steel ties is made in sections 15 ft. long, with 5 to 7 ties per section, to which the rail is fastened by specially designed clamps, and is very advantageous to lay and move, as two men can carry a section which weighs about 270 lb. Lighter rails are sometimes advocated to lessen the initial expense, and if the cars are pulled by horses or other motive power operated off the track, a rail weight of 16 lb. may be used. With locomotive haul a 20-lb. rail should be the minimum considered, and a 25-lb. rail would result in a large saving of upkeep expense. The built-up sections are held together by rail straps, or special shoes, which are of great advantage since they are quickly adjusted over the end of the rail and the bottoms of the shoes support the joints. Switches are provided of the same length as a track section, and can thus be installed at any point on track already laid, with little work. In crossing railroad or interurban tracks, the industrial track is laid over the other track, and the section on the crossing is fastened with a hinged joint so it can be lifted off and drawn to one side.

The cars used in this system are all steel of about 1½ cu. yd. capacity, and weigh about 1,000 lb. The body of the car is usually V-shaped and supported by a frame at each end in such a manner that it can be easily dumped on either side. A simple device locks the body to prevent tipping in transit. The body can also be locked when tipped about half way for convenience in loading with shovels. The frame of the car should be of heavy steel, well braced to render satisfactory service with engine haul.

The hard service of road construction with locomotive power has brought out many weaknesses in these cars that have been overcome only in the latest types. The old style cars were without end braces to strengthen the body supporting frame and provided only a steel plate over the end of the frame for a bumper with a hole in it for a coupling pin, depending on the frame to resist the pulling strain, which resulted in numerous wrecked uprights and twisted frames. Provision is now made for heavy springs in the couplings to absorb shocks, with a continuous drawbar to take the pulling strain from the frame, and rigid end braces for the body support. The axles of the older type cars operated in roller bearings contained in boxes rigidly attached to the under side of the car frame. This rigid construction allowed for no adjustment for uneven track, and a small inequality would cause a wreck. The roller bearings are still used extensively but they require daily oiling and any neglect causes wear on one or two rollers that puts the car out of use. These objections have been removed in the latest style cars by larger boxings with spring bearings, which allow an up and down play that is of great benefit on rough track. The later bearings are also of babbit or brass, with a much improved oiling system.

The motive power on these railways has generally been small steam locomotives, the most successful of which are of special design to distribute the weight and obtain a low center of gravity, as there is considerable tendency to overturn with the narrow track. The ordinary saddle-tank dinkey with short wheel base can be used, but is not to be recommended, as it causes unusual track repair expense. These special locomotives weigh from 7 to 9 tons, are 20 to 30 hp. and have a speed of 8 to 12 mi. per hour. It is better to use the larger engines. On grades exceeding 5% these locomotives are not effective and it is necessary to use a geared locomotive which is much heavier and slower. Their speed limit is about 6 mi. per hour. Steam locomotives with kerosene fuel, gasoline locomotives and auto trucks have also been utilized for pulling trains in individual cases. Hauling small trains short distances with teams is also a common and economical practice. * * *

The steam locomotives now used for hauling trains on industrial railways for road construction are not entirely satisfactory because—first, the weight requires a heavy expense in track upkeep with the light rail this class of work demands; second, the narrow gauge of the track allows these engines to tip over easily, causing serious delays and expense; and, third, a great deal of valuable time is lost in supplying coal and water, and frequently water is very hard to secure at the right location on road work.

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[*] Extracts from an address on "Transportation of Materials for Road Construction in Illinois," delivered in the 1917 Short Course in Highway Engineering at the University of Illinois.

[†] The A. D. Thompson Co., Inc., Municipal Contractors, Peoria, Ill.

Numerous advantages are claimed for hauling by industrial railways on contracts of sufficient size to warrant the expense of installation. It is affected very little by the character of the soil or the weather. It can be operated on sand, black soil or clay, and if proper drainage is provided, the hauling operations can proceed during wet periods when it would be impossible to haul by any other method. This regularity of unloading and delivery is a very considerable benefit in reducing the overhead charges and increasing the speed of construction. The subgrade is not injured and materials are kept cleaner. The speed of operation and the large tonnage possible per train recommend this system as particularly economical for long hauls.

The successful operation of an industrial railway outfit requires the transportation of materials in large daily quantity, which can be furnished only by a most efficient unloading plant. To load the train in a minimum time, storage bins with a capacity of more than one train should be provided from which the cars can be loaded during the time the engine is taking coal and water, or a train of extra cars should be provided and loaded between trips. Provision should be made at the loading terminal for furnishing coal and water to the locomotive quickly.

The number and character of cars required on a contract depends on the length of haul, required rate of delivery, methods of construction and kind of power used. If horse power be used, the trains will be smaller and cars may be of lighter construction and weight than with steam power. When the materials are dumped on the grade, a comparatively small outfit may be satisfactory by working day and night hauling gangs.

In the construction of concrete roads, many contractors have adopted special mixers and dump the cars of properly proportioned materials directly into the loading skip. When this system is used, the hauling must be done in a limited time, and the daily progress of the finished work fixes definitely the amount of materials to be hauled per day, as hauling cannot be done when the mixer is not operated. This plan requires about 50% more equipment than if the material is dumped on the grade. Provision should be made for a sufficient number of cars to operate each train with the maximum tonnage the locomotive can pull. Large trains are especially necessary on long hauls. On a track with a grade not exceeding 2% trains of thirty 1½ cu. yd. cars should be operated. One contractor the past season operated on one part of his work trains of 48 cars.

The investment necessary in an industrial railway equipment is heavier than for any other power hauling method. Outfits of track, cars and locomotives may be rented, but the character of the equipment and wearing nature of the work require a high basis for rental, and the price for one season is about 40% of the value in addition to freight two ways and heavy repairs after the return of the outfit. The average outfit for use on large contracts in Illinois road construction should provide for about 5 mi. of track. On this basis the following is an estimate of the approximate cost with the present prices of materials of such an outfit if purchased and the rental cost for one season:

COST PRICE.

5 miles built up track, 20-lb. rail @ $3,550.00	$17,750.00
6 switches @ $60 00	360.00
4 curves @ $60.00	240.00
42 1½-yd. cars without brake @ $125.00	5,250.00
8 1½-yd. cars with brake @ $145.00	1,160.00
4 flat cars @ $225.00	900.00
Locomotive, 20 hp.	3,300.00
Total..	$28,960.00

RENTAL PRICE—12 MONTHS.

5 miles built up track, 20-lb. rail, @ $2,165.00	$10,825.00
6 switches @ $24.00.	144.00
4 curves @ $24.00.	96.00
42 1½-yd. cars without brake @ $67.00	2,814.00
8 1½-yd. cars with brake @ $81.00	648.00
4 flat cars @ $90.00.	360.00
Locomotive, 30 hp.	1,500.00
Freight two ways.	1,800.00
Probable repairs.	500.00
Total	$18,687.00

The operating cost is estimated by the manufacturers at $12.00 per day, including engineer, brakeman, coal and oil.

Road Builders of Davidson County, North Carolina, at Road Institutes

In the two accompanying illustrations are shown groups of road builders of Davidson County, N. C., in attendance at the County Road Institute and at the State Road Institute held at the University of North Carolina shortly afterwards.

PATROLMEN AND FOREMEN AT COUNTY ROAD INSTITUTE, DAVIDSON COUNTY, NORTH CAROLINA.

The County Road Institute was held especially for patrolmen and foremen engaged in maintaining the 180-mi. improved road system of Davidson County. All of these men work directly under the direction of the county engineer, in what is said to be the largest organized maintenance system in the state. Because of the interest aroused by means of the County Institute there were 17 representatives of Davidson County at the state meeting this year as against one patrolman at the state meeting last year.

ROAD BUILDERS FROM DAVIDSON COUNTY AT THE NORTH CAROLINA STATE ROAD INSTITUTE.

The Board of Road Commissioners of Davidson Co. consists of Dr. J. W. Peacock, Chairman; John W. Lambeth, Treasurer; Lee V. Phillips, Secretary; Dr. E. J. Buchanan, L. A. Smith and T. H. Livengood. R. T. Brown is Engineer, Jno. C. Hicks, Assistant Engineer, and J. F. Mulligan, Superintendent. R. L. Burkhead is Clerk.

In the Downtown Shopping District of San Francisco, Cal., work requiring the tearing up of streets will hereafter be done at night. This was recently agreed upon at a conference of city officials and representatives of corporations concerned in the matter.

Reinforced Concrete Bridges*

By C. D. SNEAD†

Good roads demand good bridges—bridges which are safe, strong, sightly and durable. The new spirit which is seeking more permanent roads, free both from mud and dust throughout all the year, is not and cannot be satisfied with weak, flimsy and short lived structures such as are far too often found throughout the country. At last it has been realized that a bridge is an integral part of a road. Hardly could there be made a more pointed or striking statement than the one made at the Second National Conference on Concrete Road Building in Chicago, in February of last year, to show not only that the traffic along the road is limited by its bridges, but also to emphasize the value of planning for the future in the design and erection of bridges. The statement to which I refer is, in part, as follows:

"There are in New York State upward of 33,000 highway bridges. * * * It would be impossible to transport artillery and move troops in the State of New York in any direction over our 6,000 to 7,000 mi. of improved highways without reinforcing practically all the bridges of more than 5 ft. span. The State of New York under its highway law cannot build bridges of more than 5 ft. span. The Highway Department in its work has constructed efficient concrete culverts." And again: "But there are upward of 23,000 bridges in the State of New York on important highways that are not capable of sustaining with safety loads of 5 tons, and many of them are hardly safe for any load at all."

Thanks be to the wise framers of the Kentucky laws and to the foresight of her commissioner, there will be no room for such statements concerning her bridges in the future, if the advice and plans of her engineers are followed.

No attempt will be made to discuss the relative value of the parabolic and straight line formulae; neither the theory of concrete design nor the theory of simple, restrained or continuous beams. The design of concrete structures is a part of bridge engineering, and bridge engineering is recognized today as a specialty. The design of a concrete bridge should at least receive the same careful consideration and thought that is given a steel structure. No structure, no matter how small, should be designed by one other than an experienced structural engineer of known ability and judgment. There is no doubt that many structures have failed and others are failing due to defective design. Failure may result also from the use of faulty materials, poor execution and premature removal of forms, or, perhaps, to a combination of such causes. Eliminating the theory of design, we shall later endeavor to briefly discuss the economy, type and cost of concrete bridges and the remaining causes of failure and their prevention.

It does not seem advisable that reinforced concrete bridges should be discussed without some remarks concerning the location of a bridge in general and the necessary information that must be furnished the engineer who must design and estimate the cost. It has been said that money is made or lost on a steel structure in the drafting room and it seems to me even more probable that money has been made, or lost, in the selection of bridge sites and largely in proportion to the degree of accuracy of the report upon local conditions as expressed in the recommendations of the engineer making the survey.

We may lay down three simple rules for the choice of a bridge site:

1. Pick out a location where the axis of the stream is as straight as possible for several hundred feet and lay out the bridge at right angles to the stream. Crossings at other angles than a right angle are necessarily longer and more expensive.

2. Be sure that the site chosen offers good foundation; bed-rock if possible, or a heavy deposit of bowlders or cemented gravel. Otherwise the cost of piles or some artificial foundation must be incurred.

3. Remember that the bridge is an integral part of a road system and that to fulfill its purpose a bridge must at all times be accessible. This requires that a bridge shall be located where it not only will best serve the community, but also where well graded approaches above extreme high water may be constructed with the least possible outlay considering both grade and alignment. The cost of approaches must be reckoned in with the ultimate cost of the bridge.

After a bridge site has been chosen the engineer's duty is not simply one of running a transit line and thereafter the necessary levels from which an accurate profile may be plotted. The engineer who is to design the structure needs all the information the locating engineer can possibly secure. This information should comprise an accurate report on nature and depth of foundation, the amount of ice and drift carried at high water, the elevation of maximum high water, the approximate length and breadth of the drainage area, the current at both low and high water stages, and contours to clearly show the nature of the bridge site. Of prime importance is the location, cost, length of haul and information concerning the local materials available for bridge construction. If there is doubt as to the advisability of the use of local material do not report that the materials may be used if approved by the engineer, but send in samples for test in order that it may be definitely ascertained before bids are requestd. Lastly, do not guess concerning foundation conditions, but investigate thoroughly. The design and cost of a structure not only depend upon the information concerning the foundations but the very life of the structure may depend upon such if a hasty decision is reached and a foundation used which is questionable. * * *

Each bridge site presents conditions which may constitute a problem in themselves. In general, it is to be recommended that box culverts or arches be used for spans from 2 to 6 ft., flat slabs or arches from 6 to 16 ft., I-beam girder spans or arch forms from 16 to 30 ft., and thereafter half through or through girder spans or arches for spans 30 to 45 ft. Beyond this limit of 45 ft. arches may prove the cheaper type of construction, depending upon the location and foundation conditions. Plain concrete arches are and have been designed. Reinforced arches are to be preferred. No arches are to be recommended unless an unyielding foundation is secured. The width of roadway that is used should never be less than 16 ft. and should preferably be 18 ft. in width. Cheap types of handrails, some requiring constant maintenance, have been used. These savings on a cheap type of handrail are soon forgotten, but the appearance of the rail until rebuilt constantly detracts from the structure. Bridges composed of several units of equal length, within certain limits of heights of piers and abutments, are cheaper than a design with one long span. The waterway should not be crowded to effect this saving.

The use of cement by the Romans was due to the discovery that volcanic ash when mixed with slaked lime made a cement possessing hydraulic properties. The durability of this work was largely due to the favorable climatic conditions and to the character of the cement used. The manufacture of cement seems to have been discontinued from the downfall of the Roman Empire to the last half of the eighteenth century. In 1756 Smeaton discovered the fact that argillaceous limestone produced a lime that would set and harden under water. Portland cement, named after its resemblance to a building stone obtained on the Isle of Portland situated off the coast of England, was discovered by Joseph Aspdin in 1811. Portland cement today is largely used throughout the country. Many brands are manufactured and many good brands. All cement, regardless of its brand, should be tested. Although subject to rigid inspection, poor cement of a good grade finds its way to the market and tests are necessary to make sure that this cement does not find its way into the work.

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* Extracts from a paper of the same title presented at the 1917 meeting of the County Road Engineers' Association of Kentucky.

†Bridge Engineer, Kentucky Department of Public Roads.

The strength of concrete depends not only upon the cement, but upon the aggregate stone and sand. For reinforced concrete, stone varying from ¼ to 1 in. is recommended. All stone is not suitable for concrete work. Only stone free from weather or disintegration and of a kind known to be durable should be employed. The life and strength of concrete will depend upon the aggregate employed. The question has been asked why graded stone is specified and why the size of stone is limited to 1 in. By using graded stone we obtain the densest mixture. The smallest percentage of voids occurs in a graded mixture so graded that the voids of each size are filled with the largest particles which will enter them. The size of stone is limited to 1 in. to allow the aggregate to be properly placed around and between the reinforcing bars.

Formerly not enough attention has been paid to sand. The sand should be free from loam in excess of 4%, well graded from fine to coarse, and free from vegetable matter. The grade of sand should be as carefully selected as the grade of stone and should be equally as hard and durable. Much money can be saved by proper sand tests and recommendations resulting therefrom in regard to the proper proportion of aggregates.

To cheapen the cost of reinforced concrete bridges, sometimes, an inferior grade of steel reinforcement is employed. To cheapen the cost of a structure by the use of inferior materials cannot be too strongly condemned. With the limited tests and inspection of reinforcement, the use of "high carbon steel" reinforcement is not to be recommended. Reinforcement consisting of deformed bars of structural (medium) steel should be used. There are many types of deformed bars, some proving more satisfactory than others. It has been shown by tests that the cold and hot twisted bars have not proven as good as many other types of deformed bars, and for such reason we do not recommend their use if a better type of deformed bar can possibly be secured. It is necessary that the steel be most carefully wired in place and spaced in accordance with the dimensions shown on plans. Poor execution of the plans may spell failure for the design. Reinforcement should be free from scale, rust, oil, paint or any coating which would tend to decrease the bond.

Failure of concrete structures may occur even if the proper aggregates are secured. To guess at the proportion used, and, perhaps through lack of thought or through carelessness, to jeopardize the reputation of the designing engineer by not seeing his plans minutely followed should not be countenanced. Bottomless boxes or some similar device should be required on all jobs for measuring accurately the aggregates. After the aggregates are measured they should be properly mixed. Too much water is as harmful as too little water. The mixture should be in a "quaky" form when leaving the board or mixer. The ingredients should be thoroughly mixed until they are of a homogenous appearance and color. Mixing by machine will require not less than one minute, while mixing by hand will require that the ingredients shall be turned together at least six times.

Concrete, after the completion of the mixing, should be handled rapidly to the place of final deposit. Under no circumstances should concrete be used which has partially set. Concrete should be so deposited as to permit the most thorough compacting. All exposed faces should be thoroughly spaded with a straight shovel or slicing tool. Care should be exercised to prevent laitance which hardens very slowly and forms a poor surface on which to deposit fresh concrete.

Our discussion would not be complete without a few words in regard to forms. Forms should be constructed true to grade and line, thoroughly braced in all directions and watertight. The interior of all forms should be oiled or paraffined to prevent the concrete from adhering. In a structure built for permanency, great attention should be paid to the forms, or else a bridge which will detract rather than add to the surrounding scenery will result. Failure of concrete structures can be traced to the premature removal of forms. Forms beneath girders, arches or slabs should not be removed in less than 21 days in warm weather. In freezing weather it is well to allow the forms to remain one day in excess of the above 21 days for each day the temperature is 34°F. or below. In no case should the forms be removed until the concrete beyond all doubt has thoroughly hardened. The removal of forms should be left to the judgment of an experienced man.

Upon the completion of the work provision must be made for the proper curing of the concrete. The new concrete must be protected for a period of not less than one week from the direct rays of the sun. This is accomplished by the use of canvas, straw or sand. The new concrete should be kept wet during this period. In freezing weather no concrete work should be constructed above the ground unless the water and broken stone are thoroughly heated and thereafter the concrete properly protected. No salt should be used in reinforced concrete.

In the design of a bridge we should not overlook the aesthetic features. When bridges and culverts are constructed of permanent materials it should be remembered that any aesthetic defects that may exist will become more and more apparent as the country contiguous to the structure develops. Concrete is well adapted to artistic designs. However, it should be borne in mind that concrete is a material of individual type and should not be used to imitate other material. If form marks and the dead surface be objectionable they may be erased by tooling the surface after it is hard or rubbing while green. The plastering of surfaces should be avoided, as it is likely to peel off under the action of frost and temperature changes.

In conclusion, for strength, for solidity, for durability and for true economy reinforced concrete must be accepted as the material which excels all others for short highway spans. The short spans constitute fully 80% of highway bridges. The grades and drainage structures are the most permanent features of road improvement, and it is predicted that in coming years officials will demand concrete bridges wherever they may be economically employed.

NEWS NOTES

Washington County, Tennessee, will vote on a bond issue of $750,000 for good road purposes, on March 17. The election will be held in Johnson City.

Point San Pablo, Contra Costa County, California, and Point San Quien on the Marin County side may be joined by a $2,000,000 bridge spanning the bay between, according to a report.

An Automobile Highway to the top of Whiteface Mountain in the Adirondacks is being considered. The proposed route would run along the westerly shore of Lake Placid and then turn north to the slope and summit of the mountain. It is believed that a road could be built by private capital, and maintained as a toll road.

Concrete Road Construction in Maryland

In a paper of the above title presented at the 1917 annual meeting of the Virginia Road Builders' Association, W. F. Childs, Resident Engineer of the Maryland State Roads Commission, discussed at considerable length the methods followed in the construction of concrete roads built under the supervision of the Maryland State Roads Commission. He also reviewed briefly the history of concrete roads in that state.

Concrete is used chiefly in the tidewater and sandy sections of the Eastern Shore, the first pavement of this kind having been built on the Baltimore and Washington Boulevard in Prince George County in 1912. From some 3 mi. built during that year the total mileage of concrete pavement was increased to a total of some 180 mi. in 1915, with an additional 60 mi. under contract or completed last year. Because of lack of experience and proper equipment for this kind of work, the unit prices were slightly in excess of those for macadam in 1912. This objection was overcome the following year and the prices for 14-ft. 1:2:4 mix road, 7 in. thick at center and 5 in. thick at the edges, has varied from a maximum of $1.50 per sq. yd. of surfacing in 1912 to a minimum of 90 ct. per sq. yd. in 1915. In 1916, because of increased cost of materials and higher wages paid for labor the unit prices were somewhat higher. The average cost per sq. yd. for concrete roads built between the fall of 1912 and the summer of 1916, according to Mr. Childs, was approximately $1.24 per sq. yd. for surfacing alone.

What was described by Mr. Childs as perhaps the finest piece of concrete road of considerable length in the state is the Salisbury-Ocean City Road in Wicomico and Worcester Counties. In 1914, when the contracts for building this road were awarded, it was the practice to cover the finished pavement with tar and stone chips, ½ gal. per sq. yd. of the former being applied and covered with about 40 lb. of stone chips, giving a coating approximately 3/8 in. thick after compaction. Other contracts awarded for concrete roads in 1914 also required a bituminous top of this character and the results obtained by the use of this coating were given by Mr. Childs as follows:

> As a whole this tar mat has worn very well, but in some cases it has worn off the road in places leaving bare spots. Owing to this condition and increased cost of maintenance, by reason of patching bare spots, the bitumious mixture has not been included in the construction of the more recently built roads.
>
> The Salisbury-Ocean City Road has furnished an opportunity to compare relative advantages of a concrete road with bituminous top and without as to wear, first cost and cost of upkeep. Naturally the wear on the surface of the plain concrete road is more noticeable where disintegration under heavy traffic takes place, but this is practically negligible for the first five years it is opened to traffic, and then those places that do occur are few and can be patched as they occur with tar and chips or sand at a very small cost. The concrete road with bituminous top wears more readily; that is, the top wears and crumbles under traffic and requires constant patching and renewal. The first cost of surfacing on the 16.78 mi. of this road finished without bituminous top averaged $1.30 per sq. yd. as against $1.40 per sq. yd. for the roadway with top. This for a 14-ft. road, makes the first cost of the latter exceed that of the former by some $520 per mi. of surfacing. From the following approximate notes kept by the speaker it is seen that the maintenance cost per mile per year of the section treated with bituminous mixture exceeded that for the plain concrete section by some 14%.

Item	Cost per mile per year. Without Top	With Top
Earthwork	$13.00	$11.00
Surfacing	24.00	30.00
Materials and supplies	6.00	8.00
Total	$43.00	$49.00

> In each case cited the cost per year for surfacing includes tar and chips, while the item of materials includes small tools and materials such as shells and stones on shoulder at edge of concrete.
>
> It has been shown that in case of the road cited the first cost of the concrete road with bituminous top exceeded that of the plain concrete road by some $520 per mi. At the rate of $43 per mi. per year, maintenance cost on plain concrete road, it is seen that some 12 mi. of this type of road can be maintained for one year for the first cost of placing the bituminous top. In view of this fact and the increased cost of maintenance of the road with bituminous top, the speaker strongly recommends that the surface of the finished road be not protected with a bituminous mixture until it has worn to such an extent as to become rough. Under normal traffic conditions this should not be necessary for at least five years after the road is opened to traffic, and then a bituminous top from 1 in. to 2 in. should be placed on the roadway. This practice would save the first cost of application of tar top and maintenance on same for five years and at the end of five years the concrete base, by reason of its roughness, should be in better condition to receive the heavier bituminous top and the adhesion between concrete and bituminous material should be better effected.

There are two preliminary essentials in the construction of the concrete road, according to Mr. Childs—First, explicit and specific specifications, and, second, good inspection. "The specifications," according to Mr. Childs, "should cover completely and in detail each item entering into the construction of a concrete road. They should be explicit, not ambiguous; specific, not optional; they should be clear and easy of interpretation and should not contain clauses, the meaning of which can be misconstrued."

In regard to the inspection, Mr. Childs' paper is as follows:

> If the inspection is in charge of more than one man, one should be designated as chief inspector and he should be an intelligent man, preferably a technically trained engineer who has had some experience in concrete work supplemented by common sense along highway engineering lines. The inspection should be intelligent and thorough from the start of the job to its completion. There is no other one thing so important on concrete highway construction as the watchful eye of the inspector. Some inspectors think that their duty on the work is to antagonize the contractor and his representatives. This is a false impression. Better results will be had where reasonable cooperation exists between contractor and engineer, than when they are continually at loggerheads with each other. The number of inspectors to be assigned to any particular contract depends upon the extent of the job, methods employed in construction, contractor, and the latter's organization and equipment.
>
> If the contract is one of such extent as to warrant the use of more than one mixer, in addition to inspector assigned to grading and drainage, there should be one assigned to each mixer. If the contractor so handles the job as to complete the grading and drainage prior to laying surfacing, the services of an inspector on this work are not needed, for the same inspector can look after the surfacing upon completion of grading. The inspectors in charge of mixers can look after fine grade, subgrade, setting and lining of forms, together with mixing and placing concrete.
>
> The inspector should be constantly on the work during working hours and should see that the subgrade is carefully prepared and uniformly compacted; side-forms are properly cleaned and set to proper line and grade; aggregates are clean and accurately proportioned for the specified mix; mixing and placing thoroughly done; concrete properly tamped, finished, and cured so as not to permit of too rapid drying.

The balance of Mr. Childs' paper is taken up by a detailed discussion of the methods followed in Maryland in the construction of concrete pavements and the recommendations made by Mr. Childs as the result of his experience in active charge of construction of some 50 mi. of pavements of this kind in Maryland during the past three years. Some of the points brought out by Mr. Childs are covered in the following paragraphs.

Drainage.—Because of the evident necessity for quick and efficient drainage, Mr. Childs believes that whenever practicable the clearing, grubbing, grading and the construction of drainage works for a concrete road should be done in the fall and the road left through one winter season before laying the surface. This, he pointed out, will allow the fills to settle and give the drainage system time to become effective before the fine grading is done.

Subgrade.—In his discussion of the preparation of the subgrade, Mr. Childs said: "After 200 ft. of subgrade is prepared, as explained, it is then sprinkled with water until moist and covered with a membrane of oil paper or tar paper, such as will hold a head of water of 6 in. for 24 hours, to prevent seepage of mixing water from the concrete after it is placed on the subgrade and before it gets its initial set."

Materials.—Under the head of materials, Mr. Childs called attention to the necessity for having clean, clear water, free from oil, alkali and vegetable matter. In the past, he said, there has not been exercised as much diligence as there might have been in the testing of water for the concrete mixture. In his opinion this is an unfortunate oversight, for he believes that "there is no one other item in the mixture so important as water, and it is only right that it should be tested and the quantity and quality regulated as diligently as in the case of other ingredients."

Side Forms.—While the specifications used in the Maryland work permit the use of either metal or wooden forms, according to Mr. Childs, the latter are preferable. The principal objections to the wooden forms, he stated, are that they soon warp out of shape, are hard to keep lined up, and after repeated use grout accumulates between the top of the form and the steel angle, causing the latter to bulge between screws or fastenings and resulting in the formation of corrugations or waves in the surface of the roadway.

Joints.—On the first concrete roads built in the state, according to Mr. Childs, poured joints were made at 25-ft. intervals, but since that time the character of joint has varied, the tar paper joint having been used the most. The distance between joints has also been increased from time to time, until at present they are used only where work stops at noon and at night. The experience in Maryland has been that transverse cracks occur no matter how the joints are spaced, and it is no more trouble nor any more expensive to keep them poured with tar and sand than it is to put the same work on the joints.

In conclusion, Mr. Childs stated that the important items which enter into the construction of concrete roads are:

"(1) Carefully laid out and effectively designed drainage; (2) Well compacted and uniform subgrade; (3) Accurately measured and properly proportioned ingredients; (4) Exact consistency and good workmanship in mixing and placing; (5) Dense surface, smoothly finished, and, (6) Proper care in curing.

Standard Sizes for Stone and Gravel Prescribed by the Wisconsin State Highway Commission

A communication addressed, "To Whom it May Concern," calling attention to the establishing of standards for sizes of stone and gravel has been sent out by the Wisconsin Highway Commission through A. R. Hirst, State Highway Engineer.

The communication states that for some years conditions as to the sizing of stones and gravel furnished for road construction and concrete work have been unsatisfactory. Each plant, it is stated, has used screens selected without reference to the screens used at other plants and has numbered the sizes arbitrarily. The state on the other hand has used a different numbering, and as a result the sizes of materials secured for any work have been more or less "a matter of guess work." At the same time, the communication continues, engineers and architects have in many cases arbitrarily fixed the size of stone used for various work without taking into account the possibility of getting the size or the convenience of the plant in furnishing them. For these reasons it seemed to the State Highway Commission that it would be possible and of benefit to standardize the sizes, and accordingly communications were entered into with the Crushed Stone Association, the Wisconsin Society of Engineers and State Chief Engineer J. G. D. Mack with the idea of establishing standard screens and sizes and standard numbers. The results of these conferences, it is stated, have been very satisfactory, as the State Highway Commission, with the approval of Mr. Mack and committees of the organizations mentioned, has adopted standard sizes of stone and gravel for use in all state and state aid construction. It is also stated that the members of the Crushed Stone Producers' Association have agreed that as they renew their screens they will install those that will enable them to furnish materials to comply with these standards. The standards established by the commission are as follows:

No. 1. Material retained on a 2-in. circular opening and passing a circular opening not greater than 3½ in. in diameter.

Note: Plants may furnish as No. 1 material the product retained on a 2-in. circular screen and passing a circular screen 3½ in. or less in diameter.

No. 2. Material retained on a 1-in. circular opening and passing a 2-in. circular opening.

No. 3. Material retained on a ½-in. circular opening and passing a 1-in. circular opening.

No. 3½. Material retained on a ¼-in. circular opening and passing a ½-in. circular opening.

No. 4. All material passing a ¼-in. circular opening.

In the future state specifications from commercial plants will call for No. 1 stone for first course of macadam; No. 2 stone for the second course of macadam; and No. 4 for screenings. Nos. 3 and 3½ will not be used in new macadam construction except that possibly No. 3½ may be used for preliminary screening in certain cases.

For one-course concrete roads, state specifications will call for material retained on a ¼-in. screen and passing a 2-in. screen, **with no intermediate size removed,** being a combination of all materials included in Nos. 2, 3 and 3½.

Note: A passing screen smaller than 2 in. may be used for gravel, quartzite, granite and trap rock aggregate, provided it is not less than 1¼ in.

For two-course concrete work, the state specifications will call for first course coarse aggregate the same as for one-course concrete. The second course coarse aggregate will consist of material retained on a ¼-in. screen and passing a 1-in. screen, **with no intermediate size removed,** being a combination of Nos. 3 and 3½.

For use in absorbing surface treatments on macadam roads for first application No. 3½ is recommended; for further applications either No. 3 or a combination of No. 3 and No. 3½. Do not use No. 4, which contains fine sand or dust for absorbing purposes.

The state standard for sand will be all material passing a ¼-in. screen, provided that not more than 20% shall pass a sieve having 50 meshes per linear inch, and not more than 5% shall pass a sieve having 100 meshes per linear inch.

NEWS NOTES

Lawrence County, Tennessee, is making surveys for 40 mi. of chert roads to cost $90,000, for which bids will be asked shortly. R. M. Baker is County Engineer.

The Election in White County, Illinois, which was to have been held March 14 for the purpose of voting on a $252,000 bond issue, has been postponed indefinitely, the legality of having the election at the time stated being in question.

The City Planning Board of Boston, Mass., in a report recently presented to Mayor Curley, recommends a radical highway system connecting the civic center with the Back Bay section of the city at an estimated cost of $20,000,000, according to a report.

A Commission Composed of Five Engineers is to be formed at Atlanta, Ga., for the purpose of advising the administration on all matters relating to engineering. The engineering societies of the city have offered their services in the formation of the commission, which was authorized by the Council. The members will receive no salary.

The Construction of Water Bound Macadam Roads

Notwithstanding what has been said about the destructive effect of fast motor traffic on water bound macadam, this type of road will for some time to come remain one of our most important hard surfaced roadways, according to W. P. Caldwell, County Engineer of Boyle County, Ky., in a paper of the above title presented at the 1917 meeting of the County Road Engineers' Association of Kentucky. Mr. Caldwell believes that although water bound macadam surfaces rapidly disintegrate under modern traffic, the possibilities in surfaces of that kind have not been exhausted, and that, with more care in some features of construction, can be made to give good service in some localities where they are now considered inadequate.

Mr. Caldwell points out that the subgrade and the drainage structures represent practically the only permanent parts of an investment in macadam roads. Since the integrity of the macadam road depends largely upon the excellence of the subgrade, this important part of the construction should not be slighted. In level country, according to Mr. Caldwell, the grade of the water bound macadam road should be raised at least 1 ft. above the surrounding land, and in cuts or on fills, where the soil conditions make it necessary, provision should be made for intercepting and carrying away the ground water. No grade should exceed 6% and a level grade should be avoided to make maintenance easier. Better results, it is stated, can usually be obtained if the subgrade is completed one season in advance of the laying of the wearing surface.

The use of heavy stone and telford foundations is a thing of the past, according to Mr. Caldwell, while the use of large stone laid flat in the foundation of the macadam road cannot be too strongly condemned. A good earth subgrade, if well compacted and kept dry, will support any load that is likely to come upon the finished road. Stone for the foundation course may be of a quality inferior to that used in the wearing surface, as it is not subjected to wear or to the weather. It should be broken into sizes ranging from 3 to 4 in., Mr. Caldwell believes, and it is important to use a uniform size if uniform spreading and rolling and uniform service as a foundation are expected. Crusher run stone, varying in size from dust to 4 in., is not suitable as it cannot be kept uniformly mixed while handling. The foundation course after rolling should not be less than 4 in. thick and should rarely exceed 8 in.

There is need, according to Mr. Caldwell, for more care in the selection of the stone for the wearing surface. If the choice lies between the materials from several quarries selections should be made only after testing samples from each. The size of the stone for the wearing course should vary from 1½ to 3 in. in its largest dimension, the larger sizes being used when the stone is soft. The present tendency, it is pointed out, is to use larger stone, but the matter of size is not so important as uniformity, for in that factor lies one of the secrets of a good, lasting macadam surface. The thickness of the wearing course, according to Mr. Caldwell, seldom need be over 2 or 3 in., after compacting.

For finishing, Mr. Caldwell recommends binding with stone screenings varying in size from dust to ⅝ in. These screenings should be spread uniformly over the entire surface and swept with wire brooms until the voids in the wearing course are filled and a slight excess is left on the surface. The road should then be thoroughly watered and rolled and the process of adding screenings, watering and rolling continued until a mixture of stone dust and water pushed along in front of the roller wheels indicates that the voids are filled. A crown of ½ in. per foot is recommended.

Annual Road Builders' Conference at the University of Washington

The second annual road builders' conference was held under the direction of the College of Engineering, University of Washington, at Seattle, Wash., on March 6 and 7. For the benefit of the large number of county road officials in attendance, maintenance of country roads was made the chief topic for discussion. The principal speaker on the program was Dr. L. I. Hewes, District Engineer of the U. S. Office of Public Roads and Rural Engineering. Other speakers were T. Ives Dodge, Chairman of the Board of County Commissioners of Thurston County; Clancy Lewis, Secretary of the Washington State Good Roads Association; D. H. White, County Engineer of Pierce County; George F. Cotterill, Chief Engineer, State Highway Comission; C. D. Calley, Bridge Engineer for King County; J. W. Miller, Assistant Professor of Civil Engineering, University of Washington; Dr. H. K. Benson, in charge of the Bureau of Industrial Research, of the University; Capt. William T. Patten, Professor of Military Science and Tactics, and Prof. William Allison, of the University.

Repaving in Pittsburgh, Pennsylvania

A repaving schedule calling for the expenditure of $124,400 during the coming season has been submitted to the City Council of Pittsburgh, Pa., by Director of Public Works, John Swan. The principal items of expenditure are:

Preble Ave., $20,000; Forbes St., $15,000; Butler St., $15,000; Penn Ave., $14,000; Liberty Ave., $15,000; Market St., $9,000; Seventh Ave., $14,000; Boggs Ave., $9,000. The construction of the proposed Monongahela Boulevard is being advocated by the Pittsburgh Board of Trade.

University of Idaho Good Roads School

The program of instruction at the Fourth Annual Good Roads School, which was held at the University of Idaho, Moscow, on Feb. 27-28, included the following topics which were the subjects of papers presented by educators connected with the University, or other authorities on highway work:

"Disintegrated Granite as Surfacing Material," C. N. Little, Professor of Civil Engineering, University of Idaho; "The Highway as an Investment," Dr. L. I. Hewes, District Engineer of the Office of Public Roads and Rural Engineering; "Road Work for 1916 of the Idaho Highway Commission," E. M. Booth, State Highway Engineer; "The Columbia Highway," I. L. Collier, Professor of Civil Engineering, University of Idaho; "Use of Refined Coal Tar in Reconstruction and Maintenance of Broken Stone and Gravel Roads," Prof. C. A. Hogentogler, Professor of Civil Engineering, University of Idaho; "Hard Surfaced Roads in Whitman County," L. V. Edwards, Professor of Railroads and Highways, Washington State College. Dr. Hewes, who was the principal instructor, also spoke on "Maintenance Organization," the 1915 and the 1916 experiments of the Office of Public Roads, and gave an illustrated lecture on "Road Improvement."

A Steel Bridge Will Be Built Across the Rio Pecos at Delia, N. M., the work to begin at once, according to a report. The location of the structure, which for some time was a subject of dispute by residents along the Rio Pecos, was determined by the County Commissioners of Gaudalupe County.

An Advisory Committee of Seven Residents of Cleveland, Ohio, has been appointed by the Mayor to assist the city engineering department in planning the $3,000,000 paving program in that city. Members of the committee are C. W. Lundoff, Builders' Exchange; W. J. Carter and J. W. Frazier, Cleveland Engineering Society; F. H. Caley, Cleveland Automobile Club; J. Wayne Hart, Cleveland Federation of Labor; D. E. Morgan, Civic League; John A. Alburn, City Club.

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Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

MARCH 10, 1917.

THE IMPORTANCE OF COMPETENT INSPECTION

Probably most highway engineers fully realize how necessary competent and thorough inspection is to the proper construction of a road or a bridge. If construction work were always under the complete control of engineers, inspection would probably be better done than it is. Unfortunately, however, those at the head of the highway organizations are not always engineers, and this may perhaps explain why, apparently, little importance is attached to the inspection of engineering structures.

Two references to this matter have been made in recent technical papers. In discussing the subject of granite block pavements at the A. R. B. A. convention at Boston, William H. Connell, Chief of the Philadelphia Bureau of Highways and Street Cleaning, stated, in effect, that a great many of the failures in paving construction had been due to careless inspection and that it would seem as if this branch of the service had not been given the consideration due it. It would be far better, in Mr. Connell's opinion, to pay $10 a day, if necessary, to secure the right kind of inspectors than to lose more than the increase in pay because of poor work resulting from careless inspection. In addressing the Virginia Road Builders' Association, W. F. Childs, Resident Engineer of the Maryland State Roads Commission, urged the necessity for intelligent and experienced men as inspectors on the construction of concrete pavements, saying that there was "no other one thing so important on concrete highway construction as the watchful eye of the inspector."

The faults of inspection in much road and street work are due both to carelessness and the unfitness of the inspectors for the work they are called upon to do. There is a very decided tendency to underpay this particular branch of engineering work, and it is not to be expected that the many qualities requisite to a really good inspector can be obtained for the wages paid in a great many instances. Inspection is frequently left to either inexperienced technical graduates or to men who possess no technical knowledge, but who have had a not necessarily broad experience in inspection work of one kind or another. Most men of both these classes undoubtedly do the best they can, but that is not always good enough.

The really good inspector must possess qualifications that are somewhat rarely found in one man. In the first place, he must have a certain amount of technical knowledge, not necessarily as much as the engineer who designs and supervises construction, but certainly as much as the average engineering graduate. Again, he must have had a certain amount of experience in actual work and a general knowledge of machinery and tools. He must also have a certain aptitude in the keeping of records and in the application of systematic methods to his own work. Last, but by no means least, he must have tact, for an inspector's success or failure rests very largely upon his knowledge of men and his application of that knoweldge to the sometimes difficult tasks which come up in his daily work.

The whole problem of obtaining competent inspection resolves itself finally into the paying of adequate salaries, and, as indicated by Mr. Connell, any increase judiciously made will be gotten back in the amount saved on the work.

AMATEUR BRIDGE BUILDING

Bridges—especially new ones—do not fall down without reason, and when one does the collapse is apt to be traceable to the failure on the part of those responsible for the work to secure the services of an engineer at least for the preparation of the plans if not for both the designing and erection of the structure.

Such a case is reported elsewhere in this issue. According to our informant the bridge was planned—if that word may be used in this instance—and built under the supervision of a road official who is not an engineer. He assumed the functions of one, we are told, in order to save money—perhaps, too, as is sometimes the case, he doubted the need of an engineer to design such a simple looking structure as a 50-ft. concrete arch bridge. At any rate, he went ahead and had the bridge built in accordance with a "mental picture" of what he wanted. To superintend the job he selected a workman of little experience and no pretensions to technical knowledge. All the work was done by unskilled laborers. The result was exactly what might have been expected. When the falsework was removed the bridge broke in two and fell into the creek. This bridge failure in the middle western county is not unique—it is typical. Every working season bridges and roads fail because some one in authority believes the engineer to be superfluous or because it is thought that the engineer's modest fee can be saved. Saved for whom—or what?

The building of roads and bridges is an engineering job, and bridge engineering is a specialty, as pointed out elsewhere in this issue, in a series of extracts from a paper by C. D. Snead, Bridge Engineer of the Kentucky Department of Public Roads. The emoluments of an engineer—and that means a competent engineer—are not large; not nearly so large as fees for good legal services, for instance. Once in a while a layman, through luck, may secure good results, but not often. Fortunately, there is less such work done than formerly, but there is still too great a tendency to attempt to dispense with engineers on engineering works.

The Paving Block Committee of the Southern Pine Association, at its recent annual meeting, reported a considerable increase in the amount of wood block paving laid in 1916 over the previous year, due chiefly to the fact that more money was spent for municipal improvements than formerly. Approximately 2,500,000 yds. were laid on streets and bridges. During the year F. P. Hamilton, Paving Engineer of the association, visited practically all of the eastern cities, and a large number of those in the Middle West and in Texas in the interest of wood block paving.

Islip Section of Suffolk County, Long Island, Wants Road Improvement

A referendum vote at the spring election on proposals to expend about $500,000 on main highways in the Islip section of Long Island has been recommended by a committee of citizens which recently made an investigation of road requirements looking toward the building up of the section as a residence for people of means. The report of the committee designated for improvement roads leading to the most desirable districts and those used to a great extent by automobile travel, including Higbieland, West Islip; Fifth Ave., Bayshore; 10 mi. of Suffolk Ave., from Babylon town limits to Brookhaven town limits; Brentwood Road, Islip Ave., Islip; Great River Station Road; Bayport Ave., Bayport; Broadway Ave., from Sayville to Holbrook.

Road Work in the Southern States

According to Bulletin No. 387 of the U. S. Department of Agriculture, the annual public revenues for road and bridge construction in sixteen southern states increased from 1904 to 1914, from slightly over $21,500,000 to approximately $52,500,000.

The bulletin, which is entitled "Public Road Mileage and Revenues in the Southern States, 1914," contains text matter and tables showing the mileage of improved and unimproved roads, the sources and amounts of revenues for road work, the bonds issued and outstanding, descriptions of the systems of road administration, and other data on road work in 1914 in the states of Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia and West Virginia. The road mileage in these states at the close of 1914, according to the bulletin, was 814,567, of which approximately 73,600 mi. or approximately 9% of the total was surfaced. In 1909 surfaced roads had increased to about 6 %.

It is pointed out in the bulletin that although most of the road work is still done under the direction of the county authorities, 11 of the 16 states had state highway departments in 1914, and that such departments have been established since that time in three of the states. It is also stated that on Jan. 1, 1915, there was outstanding in these 16 states a total of $77,000,000 in road and bridge bonds.

Iowa Road Officials' Conference

The Fourth Annual Road Officials' Conference conducted by the State Highway Commission at Ames, Iowa, February 27 to March 1, inclusive, was characterized by unusual interest on the part of those who have charge of road and bridge work in the state. About 125 engineers and county supervisors attended the meetings. The program presented in the way of papers and topics for discussion such subjects as would be of greatest assistance to the county official in providing the right type of road for the everyday traffic of his community. Gravel being the only material that can be used on a large proportion of the roads of Iowa at the present time, considerable time was devoted to various phases of this topic. The program included the following papers:

"Iowa's Record for Road Work in 1916," F. R. White, Road Engineer; "Iowa's Call to the Road Builder," Hon. J. G. Weaver, Des Moines; "Oiled Roads," B. H. Piepmeier, Maintenance Engineer, Illinois State Highway Commission; "The Federal Aid Road Act as Applied to Iowa," J. C. Wonders, District Engineer for the U. S. Office of Public Roads, Omaha, Neb.; "Gravel Road Construction," F. M. Balsley, Division Engineer, Wisconsin State Highway Commission; "Results of the Physical Properties of Iowa Gravel," Prof. T. R. Agg, Iowa State College; "The Colorometric Tests for Impurities in Gravel," Prof. R. W. Crum, Iowa State College; "Iowa's Progress in Bridge Work for 1916, and the Present Material Situation," J. H. Ames, Bridge Engineer; "Official Relationship of County Engineers and County Auditors," J. M. Albertson, Auditor, Harrison County. The annual dinner was given at the Sheldon-Munn Hotel on Wednesday evening, Feb. 28.

Administration of Road Affairs in Davidson County, Tennessee

The centralization of control of all roads in Davidson County, Tenn., in which Nashville is located, is provided for in a bill recommended by the County Court. Instead of a turnpike board for the main highways, district commissioners for district roads, and a workhouse board to have charge of the work of prisoners on the roads, a highway board is to be elected by the County Court to have charge of both highways and district roads and also of workhouse prisoners. A superintendent elected by the people, and an assistant superintendent appointed by him will be in charge of road work under the direction of the board, which is empowered to appoint an engineer whenever necessary. A tax levy of 1½ mills for roads is directed, which may be raised to 2 mills. This is in addition to a district road tax of 1 mill.

Paving Contracts Awarded in Columbus, Ohio

An expenditure of $192,523.50 is represented by the seventeen contracts for street and alley paving in Columbus, Ohio, awarded by Service Director Borden on Feb. 24. The awards also covered twelve contracts for sidewalk construction. The principal contracts for street paving were as follows:

Twenty-first St., Broad St. to Mt. Vernon Ave., asphalt, A. G. Pugh, Columbus, $23,766.75; Thurman Ave., Parsons Ave. to 18th St., asphalt, Andrews Asphalt Paving Co., Hamilton, $18,019.50; Hinman Ave., 4th St. to Parsons Ave., asphalt, Andrews Asphalt Paving Co., $27,254.75; Gay St., Grant Ave. to Cleveland Ave., asphalt, A. G. Pugh, $2,168.30; Fulton St., Park Ave. to Short St., brick, George Geigle & Son, Columbus, $11,894; Pearl St., Swan St. to Second Ave., brick, B. F. Patterson, Columbus, $22,475.50; Kenworth Road, High St. to Orchard Lane, brick, D. E. Sullivan & Son, $28,768.

New Bridge Across the Mississippi River Furthers Road Improvement

Extensive construction in Crittenden County, Ark., is planned in connection with the completion of the Harahan Bridge over the Mississippi River into Memphis, Tenn. Road District No. 1 will vote on a bond issue of $125,000 in the near future for improvement of roads in the vicinity of the bridge.

It has been decided by the county to build a 12-mi. graveled road from the end of the bridge, Ferree & McCleeskey, of Memphis, being the engineers. Davis Biggs, Hulbert, Ark.; Z. T. Bragg, Hulbert, and W. A. Womack, of Waverly, are the commissioners. Work is now under way on the viaduct which is to connect the bridge and St. Francis levee. This is to be a timber structure. Ball & Peters, of Memphis, are the contractors, and the cost will be $147,000. In addition many miles of graded roads, new culverts and bridges will be built to take care of the traffic to be diverted across the bridge.

Michigan is Planning to Build Approximately 1,300 mi. of roads this year, for which work there will probably be available $1,600,000, which includes automobile license fees, state road fund and the federal appropriation. Outside of this mileage the townships and road districts will build about 300 mi. An effort through state legislation is being made to limit loads hauled over the state reward roads to 15 tons and wagons 600 lb. to the inch of tire width.

MEETINGS

Calendar of Coming Meetings

March 13.—Mayors' Association of the South Atlantic and Gulf States—Convention, Savannah, Ga. Secretary, Ernest Metcalf, Jacksonville, Fla.

March 14.—Vermont Society of Engineers—Meeting, Hotel Vermont, Burlington, Vt. Secretary, Geo. A. Reed, Montpelier, Vt.

March 27-30.—Ontario Department of Public Highways—Annual conference of County Road Superintendents and Engineers, Parliament Buildings, Toronto, Ont.

April 10-14.—Dominion Good Roads Association—Fourth Canadian and International Good Roads Congress, Horticultural Building, Ottawa, Ont., Can. Secretary, Geo. A. McNamee, 909 New Birks Building, Montreal, P. Q.

April 16-18.—Portland Cement Association.—Spring Convention, San Francisco, Cal. Secretary, F. L. Page, 111 West Washington St., Chicago, Ill.

April 17-20.—U. S. Good Roads Association.—Fifth annual convention, Birmingham, Ala. Secretary, J. A. Rountree, 1021 Brown Marx Building, Birmingham, Ala

June 11.—New York State Conference of Mayors and Other City Officials—Annual Conference, Buffalo, N. Y. Secretary, W. P. Capes, 25 Washington Ave., Buffalo, N. Y.

National Paving Brick Manufacturers' Association

A quarterly meeting of the directors of the National Paving Brick Manufacturers' Association was held at the Hotel McAlpin, New York, N. Y., on Monday and Tuesday of this week at the same time as the meeting of the directors of the National Brick Manufacturers' Association.

The meeting was largely attended and was occupied chiefly by the transaction of routine business. During the meeting it was stated that the sales of paving brick during the past year had been approximately 26,000,000 sq. yd. of paving. A banquet was held on Tuesday evening.

County Road Superintendents and Engineers of Ontario, Canada

As noted in the "Calendar of Coming Meetings," the Third Annual Conference on Road Construction for County Road Superintendents and Engineers of Ontario will be held at the Parliament Buildings, Toronto, Ont., March 27 to 30, inclusive, under the auspices of the Ontario Department of Public Highways. The purpose of the department in holding these annual conferences is to bring about uniformity of work and methods throughout the province, and to promote acquaintance and cooperation among the county road officials. Brief addresses and informal discussions constitute the larger portion of the coming program, which, it is expected, will be carried out as follows:

Tuesday, March 27.—Morning session: Introductory address, Hon. F. G. Macdiarmid, Minister of Public Works and Highways; "Departmental Requirements Regarding Annual Returns," W. Huber, Assoc. Mem. Can. Soc. C.E.

Afternoon session: "The Transportation of Materials," Geo. Hogarth, Provincial Engineer of Highways; "Maintaining Earth and Clay Roads," A. A. Smith.

Wednesday, March 28.—Morning session: "Highway Bridges," Geo. Hogarth; "Culverts," Arthur Sedgwick.

Afternoon session: "Dust Preventatives and Bituminous Binders," G. C. Parker; "Important Details in Oiling and Tarring," W. Huber.

Thursday, March 29.—Morning session: "The Highway Laws of Ontario," W. A. McLean, Deputy Minister of Highways.

Afternoon session: "Increasing the Safety of Highways," W. H. Losee; "Repairing Gravel and Stone Roads," R. M. Smith.

Friday, March 30.—Morning Session: "Reducing Construction Costs by Increased Efficiency," W. Huber.

Afternoon session: "Roads, Foundations and Drains," R. C. Muir; "Concrete Roads," H. S. Van Scoyoc, Chief Engineer, Toronto-Hamilton Highway Commission.

Pikes Peak Ocean to Ocean Highway Association

At the fourth annual convention of the Pikes Peak Ocean to Ocean Highway Association held at St. Joseph, Mo., Feb. 13 and 14, officers were elected as follows:

President, C. F. Adams, Chillicothe, Mo.; Vice President, Central District, George W. Hughes, Hume, Ill.; Vice President, Eastern District, Williams Jennings, Harrisburg, Pa.; Secretary-Treasurer, A. W. Henderson, Colorado Springs, Colo.

It was decided to hold a mid-summer meeting on the summit of Pikes Peak and in Crystal Park, near Colorado Springs and Manitou, Colo.

Bankhead Highway Association

Coincident with that of the United States Good Roads Association, the Bankhead Highway Association will hold its annual convention in Birmingham, Ala., April 19, as previously noted in "Good Roads." County conventions will be held on Saturday, April 7, in all of the counties through which the highway is expected to pass, for the purpose of selecting delegates to attend the national convention. Preparations are being made in Birmingham for the reception of the delegates and visitors, among whom are expected to be a number of public men interested in the location of the highway in the various states.

Portland Cement Association

As noted in the "Calendar of Coming Meetings" the spring convention of the Portland Cement Association will be held at San Francisco, Cal., April 16-18.

The meeting, which will be held at the Palace Hotel, will be the first in the history of the association held west of Chicago. It has been announced that a special train has been arranged for the trip from Chicago to San Francisco over the Northwestern, Union Pacific and Southern Pacific routes. The train will leave Chicago at 8:00 p. m., Friday, April 13, and arrive at San Francisco at 9:00 a. m., Monday, April 16.

At the conclusion of the committee and business sessions of the association the members in attendance will go in a body to Del Monte, Cal., and spend April 19 and 20 in an outing.

At a recent meeting, the Society of Automobile Engineers and the Society of Tractor Engineers united with aeronautic and marine engineers to form an organization known as the Society of Automotive Engineers. One of the activities planned for the society is standardization work in the tractor field. A committee having this work in charge has already met.

PERSONAL NOTES

Robert Gaw, of North Bergen, N. J., has been appointed Supervising Engineer of all work in connection with the Hudson County Boulevard. He succeeds Frederick Dunham.

Walter L. Weeden has succeeded Zenas W. Carter as Field Secretary of the Granite Paving Block Manufacturers' Association of the U. S., Inc., 54 Devonshire St., Boston, Mass.

W. H. Bircher, of Scranton, Pa., Superintendent of Lackawanna and Wayne Counties, has been promoted to Acting Assistant Engineer in charge of District No. 12. Mr. Bircher has been with the Pennsylvania State Highway Department seven and a half years in various engineering capacities.

H. G. Fenstermacher, of Allentown, Pa., has been appointed Superintendent of Lehigh and Northampton Counties, succeeding Edwin Bytheway who recently resigned on account of illness in his family. Mr. Fenstermacher has been on the engineering staff of the Pennsylvania State Highway Department for five and a half years.

Stanley E. Bates, Assoc. M. Am. Soc. C. E., formerly editor and manager of "The Contractor," has become connected with the Lee Loader & Body Co., 2543 South LaSalle St., Chicago, manufacturer of the Lee loaders, motor truck bodies and other equipment used in handling and hauling materials. Mr. Bates will have charge of the Sales Department of the company.

W. A. Van Duzer, Assistant Engineer of the Pennsylvania State Highway Department in charge of District No. 12, comprising the counties of Lackawanna, Monroe, Pike, Wyoming, Wayne and Susquehanna, has resigned his position with the department to engage in private business in another state, according to a recent announcement of the State Highway Department.

Clark R. Mandigo, of the engineering staff of the Portland Cement Association, has been appointed Consulting Engineer of the Western Paving Brick Manufacturers' Association. He will have charge of the service department of the association, his address being 416 Dwight Bldg., Kansas City. Mo. Mr. Mandigo was Assistant City Engineer of Kansas City from 1911 to November, 1916.

Ernest Leslie Ransome, Chairman of Board of Consulting Engineer of the Ransome Concrete Machinery Co., Dunellen, N. J., died recently at the home of his daughter, Mrs. F. V. Lawrence, Plainfield, N. J. Mr. Ransome, who was seventy-three years old, was the inventor of the Ransome concrete mixer. He was a pioneer in concrete construction, having built one of the first reinforced concrete structures in New Jersey.

W. R. D. Hall, Statistician of the Pennsylvania State Highway Department, resigned on March 1 to become manager of the Publicity Bureau of the Chamber of Commerce of Philadelphia, Pa. Mr. Hall has been with the State Highway Department since October, 1913, during which time he has had charge of all of the publicity work of the Department and has edited "Pennsylvania Highway News," the official organ of the Department. Before taking up this work, Mr. Hall was employed in various reportorial and editorial capacities on the "Call," the "Evening Bulletin," the "Press," the "Evening Telegram," and the "Inquirer" of Philadelphia. Mr. Hall is a member of the Engineers' Society of Pennsylvania and in 1898 served in the First Regiment, U. S. Volunteer Engineers, seeing service in Porto Rico.

S. L. Miller has resigned from the Illinois State Highway Department, at Springfield, Ill., and is now engaged on railroad pier construction work at Hannibal, Mo.

W. J. Devereaux, of Scranton, Pa., Chief of Construction of Pennsylvania State Highway Department, District No. 12, has been made Superintendent of Lackawanna and Wayne Counties, to fill the vacancy caused by the promotion of W. H. Bircher.

PUBLICATIONS

"SOME FACTS AND FIGURES ABOUT NORTH CAROLINA AND HER NATURAL RESOURCES." Second Edition. Prepared by the North Carolina Geological and Economic Survey. Paper, 4x6 in., 51 pp. and covers.

This pamphlet prepared specifically for the use of the general assembly of 1917 comprises, as its title indicates, miscellaneous data on North Carolina. Among the topics treated are the forests, roads, drainage, geology and mineral resources and water powers. There is also included a list of the publications of the North Carolina Geological and Economic Surveys. The subject of good roads occupies 9 of the 51 pages.

"PUBLIC ROAD MILEAGE AND REVENUES IN THE SOUTHERN STATES, 1914." Bulletin 387, U. S. Department of Agriculture. Contribution from the Office of Public Roads Rural Engineering. Issued Feb. 20, 1917. Paper, 6 x 9 in.; 121 pp. and covers.

This bulletin is a part of a series dealing with road data in the various states of the Union in 1914, of which Bulletins Nos. 386 and 388 have previously been printed, the former dealing with the Middle Atlantic States and the latter with the New England States. It is arranged in the same manner as the other two bulletins and includes data on the following states: Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia and West Virginia.

NEW JERSEY COMMISSIONER OF PUBLIC ROADS. Tweny-third Annual Report for the year ending Oct. 31, 1916. Cloth, 6x9 in., 110 pp.

This report of the Commissioner of Public Roads follows previous reports in arrangement of subject matter, containing, besides general data on road work in the state, detailed reports of the work in each of the several counties, the report of the commissioner and the reports of the state highway engineer and division engineers. There are also included extracts from the township aid law, a report on road accounts, a report of the surveying corps and a report on laboratory and experimental work. The report is illustrated by a number of half-tone reproductions of photographs of road work in progress and completed.

NEWS NOTES

The City of Jacksonville, Florida, is preparing to spend $375,000 on street construction.

The City Commission of Nashville, Tenn., has authorized a bill in the legislature calling for an election on a bond issue of $220,000 for rebuilding viaducts. W. W. Southgate is City Engineer.

The Board of Supervisors of Union County, Mississippi, has sold the first block of $100,000 of the bond issue of $300,000 to the Merchants & Farmers Bank, Bank of Commerce and Bank of Albany. Surveys of roads have been made.

Governor Withycombe of Oregon recently signed a legislative bill providing for a $6,000,000 road bond issue, and a bill providing for a special election in June at which time the bond issue will come before the people.

GOOD ROADS

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Number
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New Interstate Bridge at Portland, Oregon

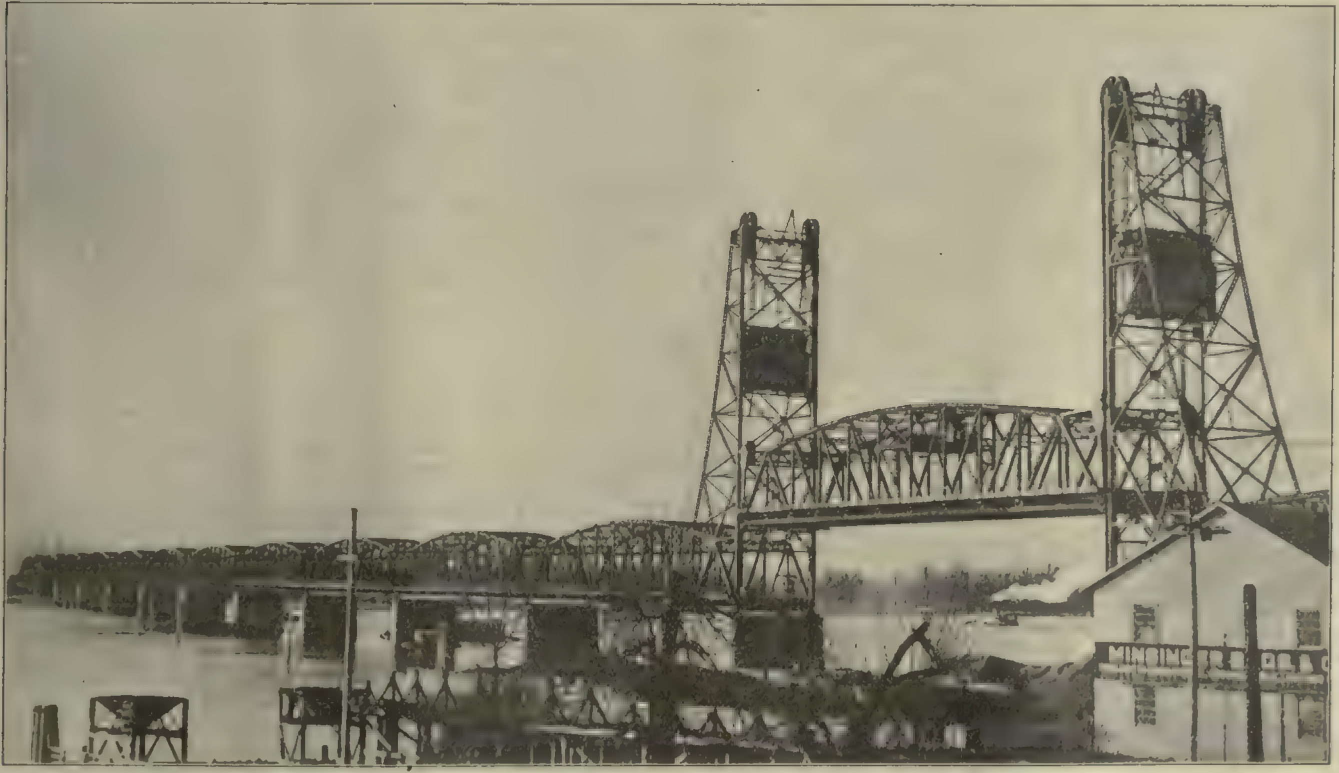
By **ROY A. KLEIN**

The new bridge crossing the Columbia River and connecting Portland, Ore., and Vancouver, Wash., the opening of which was noted in a recent issue of "Good Roads," is an important link in the Pacific Highway. Including its three approaches it has a total length of 23,000 ft., and cost approximately $1,750,000.

The bridge proper, spanning the main channel of the river, is 3,530 ft. long and consists of 10 steel truss spans each 265.5 ft. long, 3 truss spans each 275 ft. long, and 1 girder span 50 ft. long. One of the 275-ft. spans is a movable span of the vertical lift type which, when raised, gives a clearance of 150 ft. above ordinary high water. The approach at the Vancouver end of the bridge is 600 ft. in length. At the Portland end, Hayden Island is crossed on an embankment 1,480 ft. long, and the Oregon Slough by an 11-span plate girder bridge 1,140 ft. in length. There are two approaches to the south end of the structure over Oregon Slough. One of these, about 10,800 ft. long, connects with Union Avenue, and the other, about 5,800 ft. long, connects with Derby Street, Portland. On the Union Avenue approach is a 4-span plate girder bridge 307 ft. long over Columbia Slough. The balance of the approaches consists of embankments of an average height of 24 ft.

A roadway 38 ft. wide is provided by the bridge from Vancouver to the south side of Oregon Slough. From that point to Portland a 30-ft. roadway is provided on the Union Avenue approach and an 18-ft. roadway on the Derby Street approach. There are sidewalks 4½ ft. wide on the truss spans, and 5½ ft. wide on the girder spans, and on the approaches south of Oregon Slough provision has been made for the addition of sidewalks. Rails for both standard and narrow gauge, double-track electric railways are provided.

A total of 1,465,000 cu. yd. of sand was used in the construction of the various embankments. The concrete piers supporting the bridge contain a total of 23,000 cu. yd. of concrete, and approximately 1,800,000 ft. of timber and 223,000 lin. ft. of piling were used in their construction. The bridge proper over the Columbia River contains a total of 6,875 tons of structural steel, 310 tons of steel rails and 180 tons of machinery and cables. The spans over the Oregon and Columbia Sloughs contain 1,600 tons of structural steel and 130 tons of steel rails.



NEW INTERSTATE BRIDGE OVER THE COLUMBIA RIVER BETWEEN PORTLAND, OREGON, AND VANCOUVER, WASHINGTON—OPENED TO THE PUBLIC ON FEBRUARY 14.

The sidewalks on the bridge proper are of concrete and the roadway is paved with bitulithic supported on concrete slabs. There are about 17,000 sq. yd. of pavement on the bridge and about 47,000 sq. yd. on the embankments.

An unusual feature in the construction of the bridge was the erection of the spans on the shore and the floating of each of them to its position without delay or accident.

The foundations were built by the Pacific Bridge Co. The steel was fabricated by the United States Steel Products Co. and the Northwest Steel Co., and erected by Porter Brothers. The embankments were built by the Tacoma Dredging Co. and the Standard American Dredging Co., and the pavements were laid by the Warren Construction Co. The engineers were Harrington, Howard & Ash.

The Maintenance of Earth Roads[*]

By F. L. DUFFY[†]

You often hear engineers talk of permanent roads when speaking of concrete, brick, or bituminous concrete roads but no road is as permanent as the earth road. The life of an earth road, however, has never been determined. It will continue to be a good road just as long as it is maintained properly. A few years ago the custom of maintaining earth roads, where they were maintained at all—and this was only in rare instances—was to shape them once a year with a blade grader and neglect them the remainder of the time. Holes which had become so deep that they were impassable all winter were filled with rock and became much larger than they were at first. Experience has taught engineers that the surface of an earth road can be vastly improved if a little work is done often; not attempting very much at one time but merely smoothing over the surface, filling the ruts and small depressions when the earth is moist, thus forcing the water to the side ditches and packing the surface. For this kind of work it has been found that the road planer or split-log drag gives the best results. However, before dragging the mud should be removed from all holes and fresh earth substituted.

Many split-log drag enthusiasts, however, have overestimated the value of the road drag by leading the public to believe that it will be necessary only to use the drag to procure good roads. This mistake in many instances has caused people to discard the drag after finding that the roads were placed in little better condition than they were before dragging was begun. The drag will not form a crown nor will it open ditches. Its only use is to maintain a crown, waterproof the surface, fill up the small depressions and cut down the high points. Therefore, a road must be shaped and drained before the drag can be used successfully.

In shaping the road surface a blade grader should be used and should be operated so that a crown of 1 in. per foot is obtained. An experienced man should operate the grader, as more harm can be done in a short time with one of these machines than with any other machine used to maintain earth roads. With an experienced man at the wheel, a well rounded cross-section can be formed which will tend to keep traffic distributed over the whole road surface and not in the two distinct and separate tracks which are caused by use of a triangular cross-section.

Side ditches should be broad and shallow and so constructed that they can be cleaned by the use of drag scrapers. While many prominent engineers consider it the best engineering practice to construct narrow ditches, 3 ft. or more in depth, the more shallow and wider ones are considered by most engineers more economical since they can easily be cleaned with scrapers and water is distributed over a larger area so that it does not cut out the bottom of the ditch.

* * * * * * * *

In dragging a road the whole surface should be dragged, beginning at the outer edge and dragging toward the center, for when a loose ridge is left in the center to be compacted by traffic this part of the road is avoided and in a very short time two lines of traffic will be formed. Grass and weeds will then grow in the center, causing ruts to be formed along each side which will prevent the water from being carried to the side ditches, and the rain will make the road almost impassable. When the whole road is dragged a uniform crown is maintained and traffic is distributed over the whole surface which wears uniformly and the water will flow to the side ditches instead of into the ruts. The driver by changing his position and changing the hitch on the drag can regulate it so that it will cut deep or shallow and also work the earth towards the center or away from it as is desired.

When working on an earth road it must always be kept in mind that it must be made as near waterproof as possible and if anything is done to disturb this condition it will prove harmful. It should not be expected that maintenance of an earth road will prevent mud; the most that can be accomplished is to have less mud.

All a drag can do is smooth the surface of the road, and, by puddling it, waterproof it to a slight extent. When the road dries out after dragging, this waterproof coat becomes hard and better suited to resist the wear of traffic. The oftener the road is dragged the thicker the coat becomes.

Engineers differ widely on the proper time to drag a road, some advocating that it be dragged during or just after a heavy rain, while others think that better results can be obtained if it is dragged several days after a rain when the earth is moist. The latter practice will be found the most satisfactory in this state. Dragging a road once or twice while it is slushy is advisable when there are deep ruts in the road or just before freezing weather. By dragging a road just before it freezes a smooth frozen surface will be formed which will be as serviceable as a macadam road as long as it is frozen. When the roads have frozen up very rough in the early winter the sharp points sometimes become softened or dried out. At this time a planer may be used to advantage, making the road much smoother during the remainder of the winter and greatly benefiting it during the breaking up of cold weather.

Particular attention should be paid to keeping the road well dragged when the frost is coming out of the ground in the spring and after the frequent rains at that ime of the year. The cost of maintaining an earth road will not only vary as the cost of labor but will also be affected by the amount of traffic and climatic conditions. It may easily be seen that it will be easier to maintain a road in a country having a moderately dry climate than in one which has continued wet seasons. Any one knows that it will cost more to maintain a road under heavy traffic than under a light one.

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[*] Extracts from a paper presented at the fifth annual meeting of the County Road Engineers' Association of Kentucky, Bowling Green, Ky., January 17-20, 1917.

[†] Assistant State Highway Engineer of Kentucky and Secretary of the County Road Engineers' Association.

The Tennessee Legislature has authorized Greene County to issue $500,000 in road bonds.

Ware County, Georgia, will vote in April on a bond issue of $1,000,000 to build roads from Waycross in all directions. The work will also include bridge construction.

State Road Work in New Jersey During the Past Year

The growing necessity for maintenance work due to increased traffic and the greater destructive effects of modern traffic are shown strikingly by figures given in the 23d annual report of the Commissioner of Public Roads of New Jersey for the year ending October 31, 1916, which has just been issued. According to the report all reasonable requests for aid in repair work could be met by the department six years ago, while the requests for aid for the fiscal year of 1916-17 amounted to $3,299,253 and for 1917-18, $2,322,936, or over $5,600,000 for the two years, which sum, so far as could be estimated at the date of the report, was nearly three times the amount that will be available.

During the fiscal year from Nov. 1, 1915, to Oct. 31, 1916, there was expended from state aid funds a total of $1,339,952.64. Of this total $399,838.78 was expended on road and bridge construction during the year; $107,727.17 was used for administrative expenses and convict labor; and $832,386.69 was spent for repair and maintenance under the motor vehicle account.

NEW JERSEY STATE AID ROAD BETWEEN SCOTCH PLAINS AND MOUNTAIN SIDE, UNION COUNTY—18-FT. CEMENT CONCRETE PAVEMENT—3-FT. MACADAM SHOULDERS.

The $399,838.78 expended for new construction represented the state's share of the cost of work amounting in all to $1,105,225.70 and covered a total mileage of 65.3. The amount given includes payments on contracts, payments for extras, and engineering and inspection charges. It was paid from three appropriations as follows: From 1916 appropriation $93,988.41; from 1915 appropriation $234,031.67; from 1914 appropriation $71,818.70. Details of road and bridge construction are shown in table I and table II, respectively.

The $107,727.17 expended from general appropriations was divided as shown in table III.

The expenditure of $832,386.69 under the motor vehicle account comprised $716,361.69 paid on allotments, $3,000 appropriated for the expense of assistant supervisors and $153,025 appropriated for the expense of the Motor Vehicle Department. The largest item, that for the amounts paid on allotments, was used almost entirely for repair work in amounts varying from $59.34 up to $40,000 in various counties. It also included $3,642.07 paid for tags for the Motor Vehicle Department and about $800 for miscellaneous expenses. In addition to this expenditure from state funds there was expended from county funds for repairs and resurfacing during the year approximately $1,700,000.

In discussing convict labor on roads, Commissioner Stevens reports that the state's experience of about four years persuades him of three things: "First, that work can be done by this means at the same, or less, cost than by contract; second, that this class of work is a specially promising method of preparing convicts for a law-abiding and useful career; and, third, that we are by no means availing ourselves of either of the above opportunities." Under the present laws, according to Commissioner Stevens, the division of responsibility and control of convict labor "works havoc with efficiency."

The legislature of 1916 passed a law known as the Township Aid Law, which provides for the improvement of township roads with state aid. Under the terms of this law, township authorities may apply to the Commissioner of Public Roads for aid in the improvement of any given road. The Commissioner is empowered to decide which application in any county will best serve the interest of the township, county and state, and, if he approves, must enter into an agreement with the township authorities for the prosecution of the work. The work may be done by contract or by convict labor. The work which can be done under this act includes the survey and preparation of plans, the grading, the construction of bridges and culverts and the drainage system, and the laying of pavements.

The state pays not over 50% of the cost of actual work and in addition the cost of making surveys and preparing plans, the latter being done by the State Highway Department.

The state's share of the cost is to be paid out of an appropriation of $105,000 annually from the net receipts of the motor vehicle fund. The portion paid by the township may be raised by a tax levy or by temporary loans.

TABLE I.—ROADS IMPROVED BY STATE AID IN NEW JERSEY—FISCAL YEAR ENDING OCTOBER 31, 1916.

County	Name of road	Paved length (ft.)	Paved width (ft.)	Kind of pavement	Total cost allowed by state	Amount paid by state (40% of cost)
Atlantic	Northfield Road	579.40	20	gravel	$ 1,886.95	$ 754.78
Atlantic	Wheat Road and 12th St.	72,795.50	20.0 29.3 30.0	gravel macadam	73,258.39	29,303.36
Atlantic	Oyster Creek Road	18,300.00	20	gravel	21,274.85	8,509.94
Bergen	Kinderkamack Road	11,128.00	16	Amiesite	51,746.77	20,698.71
Bergen	Market St.	15,158.85	16	asphalt concrete	75,253.81	30,101.52
Burlington ...	Hartford-Fairview	5,985.50	16	macadam	9,787.94	3,915.18
Camden	Main St., Haddonfield	6,132.40	varying	brick Amiesite	36,062.19	14,424.88
Cumberland ...	Landis Ave.	51,439.00	22 30	gravel	29,659.14	11,863.65
Cumberland ...	Millville-Maurice River Road	39,350.00	22	gravel	41,390.82	16,556.32
Gloucester	Mullica Hill-Woodbury Turnpike (1)	35,745.60	..	....	25,000.00	12,500.00
Hunterdon	Frenchtown Borough Road	1,796.00	16	macadam	3,504.92	1,401.97
Hunterdon	Lebanon-Clinton Road extension	848.00	16	macadam	2,299.15	919.66
Middlesex	Roosevelt-Woodbridge	10,392.20	16	concrete	35,014.18	14,005.67
Middlesex	Schalk's Station Road	12,116.00	18	gravel, lignin binder	16,118.86	6,447.54
Morris	Sussex Turnpike	5,615.57	18	bituminous concrete amiesite	24,903.30	9,961.28
Ocean	Toms River-Lakehurst Road	5,000.00	24	gravel	13,299.36	5,319.74
Somerset	Finderne Ave.	5,490.00	16	macadam	11,905.68	4,762.27
Sussex	Newton-Branchville Road	23,691.00	16 14	broken stone	55,735.56	27,294.22
Union	Shunpike Road	1,468.00	16	macadam	3,430.00	1,372.00
Union	Wood Ave., Linden	5,992.60	20	cement concrete bituminous concrete	30,796.90	12,318.76
Warren	Fish Hatchery Road (2)	7,920.00	..	....	....	....
Warren	Bloomsbury-Still Valley Road	15,393.41	1[illegible]	macadam	38,527.20	15,410.88
		342,247.03			$606,855.87	$242,942.33

(1) Turnpike purchased; (2) an institutional road.

The duty of maintaining the roads improved under the Township Aid Law devolves upon the township committee of the township in which the improved road is situated. The State Commissioner of Public Roads may agree, however, in any year to assume a share not exceeding half of the cost of maintenance and to pay that amount out of the receipts of the motor vehicle fund.

TABLE II.—BRIDGES BUILT BY STATE AID IN NEW JERSEY—FISCAL YEAR ENDING OCTOBER 31, 1916.

County	Name of bridge	Type of bridge	Total length (ft.)	No. of spans	Length of spans	Total cost allowed by state	Amount paid by state
Atlantic	Bass Harbor	Creosoted timber trestle	245.00	20	12'-3"	$ 16,957.25	$ 1,695.73
Atlantic	Broad Thorofare	Strauss bascule; creosoted timber approaches	1,400.00	70 1	12'-0" 60'-0"	78,725.80	7,872.58
Atlantic	Hospitality Creek	Creosoted timber trestle	448.56	83	11'-9¼"	23,480.84	2,348.08
Atlantic	Northfield	Reinforced concrete slab	18.00	1	18'-0"	2,164.55	216.45
Atlantic	Patcong Creek	Steel draw-span; creosoted timber trestle	496.00	28 1	12'-0" 116'-0½"	42,326.88	8,465.38
Atlantic	Risley's Channel	Scherzer 2-leaf bascule, creosoted timber approaches	1,130.00	83 1	12'-0" 90'-0"	77,558.45	7,755.85
Atlantic	English Creek	Steel truss	74.(apx.)	1	52'-0"	5,991.20	1,198.24
Atlantic	Lake's Creek	Concrete encased steel girder	78.00	1	28'-0"	4,875.44	975.09
Mercer (1)	Back Creek	Steel I-Beams and concrete	40.00 60.00	1 1	15'-0" 20'-0"	2,716.30	543.26
Mercer	Miry Run	Steel I-beams and concrete	45.00	1	15'-0"	1,820.00	364.00
Mercer	Assunpink Creek	Reinforced concrete box culvert	22.00	1	6'-0"		
Middlesex	Devil's Run	Reinforced concrete slab	......	1	20'-0"	1,400.00	280.00
Union (2)	West Brook	....	......	..	....	1,900.00	380.00
Warren	Pohatcong Creek	Reinforced concrete arch	......	1	60'-0"	8,441.00	1,688.20
Warren	Pohatcong Creek	....	......	..	....	595.80	119.16
						$268,953.51	$33,902.02

(1) Two structures.
(2) Widening job.

This law became effective on July 1, 1916, and there were received about 65 applications from 11 counties. In many instances the requests for aid could not be granted because the roads for which applications were received had already received state aid in some other form. The applications received and approved by the State Commissioner of Public Roads numbered 35 and called for aid amounting to a total of $78,821.28.

Besides the roads improved during the year there were at the date of the report 36.895 mi. of road approaching completion having a total cost of approximately $548,049.86. There were also under construction about 25 bridges at a total contract price of about $207,000.

Various recommendations regarding the operations of the Department of Public Roads are contained in the reports of Commissioner Stevens, State Highway Engineer R. A. Meeker, and the division engineers. Referring to the matter of salaries, Commissioner Stevens points out that the present salary of the State Highway Engineer, $4,000 a year, is inadequate. Commissioner Stevens says of the State Highway Engineer and his duties, "He is held responsible to the Commissioner for all engineering details. Whether the present system of centering all legal responsibility on the Commissioner or other department head be continued, or whether the engineering responsibility be placed by law on the State Highway Engineer does not affect the duties nor the real responsibility of his office. His salary should be $7,500." Commissioner Stevens also recommends increasing the salaries of the division engineers from the present maximum of $2,000 a year to $4,000. He suggests that they be appointed at about $2,000 a year and raised $250 a year until the maximum is attained.

TABLE III.—EXPENDED FROM GENERAL APPROPRIATIONS NOVEMBER 1, 1915-OCTOBER 31, 1916.

Item	Amount
Salary of Commissioner..............................	$ 5,000.00
Salary of State Highway Engineer....................	4,000.00
Salary of division engineers (annual and supplemental)	6,750.00
Clerical and office expense.........................	12,795.67
Expense of surveying corps (appropriation and earnings)	6,389.11
Administration of township roads act................	2,011.16
Survey of state highway system......................	519.43
Purchase of automobile..............................	394.98
Convict labor (annual and supplemental).........	69,866.82
	$107,727.17

Another matter referred to by Commissioner Stevens is

REALIGNMENT ON THE HEWTON-SUSSEX ROAD—OLD BRIDGE AT LEFT, NEW STRUCTURE AT RIGHT.

LAYING DURAX BLOCKS ON THE PATERSON AND HAMBURG TURNPIKE—18-FT. PAVEMENT.

that of accounting. He points out that with the present lack of a uniform system for keeping the accounts of public bodies it is impossible to prepare reliable statistics for the state as a whole. He points out that it is of prime importance to have full and accurate accounts of all money spent on roads in the state. He also points out that the Budget Act makes it necessary for the department to undertake an increased amount of clerical work in the preparation of estimates and suggests the appointment of an accountant to have charge of this work at a salary of $3,000 a year.

In Mr. Meeker's report attention is called to the necessity for better planning and execution of road work because of increased traffic requirements and states that to take care of it the engineering force should be at least doubled. This recommendation, he states, also applies to some of the county engineers.

In the report of E. M. Vail, Division Engineer of the Northern Division, attention is called to the necessity of removing encroachments from the right of way. These include improperly built private entrances, guard rails built too near the traveled way, fences and sometimes buildings.

Edward E. Reed, Division Engineer of the Central Division, calls attention in his report to the application of bituminous surface treatments to water bound macadam roads. The custom of having the county apply this treatment after the expiration of the contractor's maintenance period has not worked out satisfactorily, he states, because the county does not always do the work. He recommends that when specifications are prepared for water bound macadam construction they include the application of the surface treatment.

Uniform Traffic Bill Approved by New York Assembly

The bill known as the "General Traffic Law," providing uniform traffic regulations in New York State, which was introduced in the State Assembly on Jan. 12, has been reported favorably by the assembly. The bill was introduced by Assemblyman Clarence F. Welsh, and is favored by automobile interests. Its general provisions were printed in "Good Roads" for Feb. 3, 1917, page 66.

Road Projects in Minnesota to Receive Federal Aid

The Minnesota State Highway Commission has approved the report of the State Engineer designating the roads to be improved with joint funds received from the federal government and the counties in the state. The federal aid to be given each county listed below is half the estimated cost of constructing the mileage therein selected for improvement.

County.	Road.	Length (miles)	Est'm't'd Cost.
Pine	Twin Cities-Duluth	50	$160,000
Chisago		31	110,000
Carlton		2	5,000
Sherburne	Scenic Highway	10	30,000
Mille Lac		52	100,000
Crow Wing		20	60,000
Freeborn	Jefferson Highway	14¼	46,400
Carver	Yellowstone Trail	20	30,000
Winona	River Road	10	24,000
Hennepin and Scott	Albert Lea Trail (Minnesota River Crossing)	4	45,000

VIEW ON THE ENGLEWOOD APPROACH—A ROAD UP THE PALISADES AT ENGLEWOOD, N. J.

ENGLEWOOD APPROACH—VIEW SHOWING LOCATION AND STONE PARAPETS.

Building Roads with Borrowed Money[*]

By EDW. ST. C. SMITH[†]

It has been a common experience of good roads promoters to have to overcome a popular prejudice against the borrowing of money and the bonding of the property of a community for public improvements. The first argument usually advanced by those opposed to the plan is that it will increase taxes, in order to liquidate the principal and interest of the loan, in a community already overburdened by general taxation.

This latter statement must be admitted as true in general in the average community, and it then becomes the task of the bond issue advocates to convince the voters and taxpayers that the small increase in taxes is returned many fold in actual dollars and cents in the economic benefits of good roads.

Any good business man will readily invest one dollar to get two in return if he is satisfied with the soundness of the investment, but if it is necessary to borrow the money and mortgage his property he must be convinced that the investment will actually yield the returns expected. So, in the case of borrowing money to build roads, the project should be so well planned and constructed that it will at all times represent the full value of the money put into it.

If it is a wise business policy to borrow money to finance any legitimate business, surely it is equally justifiable for a community to borrow money for public improvements that directly affect the economic welfare of that community.

However, just as in the case of any other business proposition financed with borrowed money, the utmost precaution should be taken to safeguard the investment to the people before deciding to incur the public debt. A grave responsibility rests upon those having to do with the placing of a bonded indebtedness which must be paid by the people, no matter what the outcome of the proposed improvement.

It is not the purpose of this paper to discuss the benefits of good roads, because they are now generally well known. The important thing at present is to know how to get them in such a way that every dollar expended will be represented by a dollar's worth of improvement.

Public roads must be built with money raised either by direct taxation or by bond issues. If the amount required could be raised by direct tax levy within the lawful limit it would undoubtedly be advisable to obtain it in that way and thus avoid paying interest on bonds, but in most communities it would be impossible to raise a sufficient amount in this way and it would therefore be many years before general road improvement could be obtained. We are all familiar with the usual disposition of the annual road and bridge fund of the average county. It is dissipated each year in patching and repairing roads which have never been properly constructed and little permanent improvement is effected from year to year, notwithstanding the fact that millions of dollars are being expended annually in this way throughout the United States.

No permanent or immediate benefit can be obtained from such piecemeal construction, so it becomes necessary to have available a sum of money sufficient to construct at once a system of good roads consistent with the requirements of present and anticipated traffic.

The writer has often heard the remark: "Yes, we are badly in need of better roads in this county, but we cannot afford to go in debt for them." And I always want to say: "You can better afford to go into debt for good roads than to continue to pay the price you are paying each year for bad roads, because the difference will more than pay the interest on the debt, while you will have the use of good roads in the meantime." If taxpayers could only be made to realize the actual cost of bad roads there would be fewer bond elections defeated.

Before a bonding proposition is placed before the people there are certain essential facts which should be determined and the information obtained made public. First, a classification of all of the roads of the county or district according to the traffic carried by each, to determine the mileage of main market roads and tributary roads or feeders; second, the cost of hauling per ton mile over present roads compared with what it will cost over the improved roads, from which an estimate can be made of the annual saving resulting from the improvement; third, the present value of lands adjacent to the roads and their increased value by reason of the improvement; fourth, a careful estimate of the cost of the roads to be improved, prepared by a competent highway engineer; and, finally, the amount necessary to finance the project, whether to be raised by direct taxation or by bond issue.

With this information in hand an intelligent conclusion can be reached as to how much money a county can afford to spend in the proposed road improvement, the type of roads best suited for the requirements and the number of miles it can afford to build. Also, from the above investigation the taxpayers can be shown what such an investment will mean to them in the decreased cost of hauling over improved roads ready for use at all seasons of the year.

Purely as a business proposition, our railroads spend millions of dollars (nearly always borrowed money) in reducing heavy grades and sharp curves in order to haul greater tonnage at less cost. The same principle applies to the spending of money on highways to decrease the cost of hauling and connect the producer with the consumer.

In building roads on borrowed money, a timely warning should be sounded against a mistake often made, namely, the neglect to provide for the future maintenance of the new roads. The prevailing opinion seems to be that, once built, a road is good for all time. No greater fallacy could be imagined. No road is ever completed in that sense because it is subject at all times to the breaking down process of traffic wear and the deteriorating effects of the elements. Care and maintenance of a road must begin the day that construction ends and be religiously continued during the life of the road. Only in this way can the investment be preserved to the community. The maintenance then becomes a fixed charge which must be taken into account and provided for and therefore constitutes a part of the ultimate cost.

It would be an indefensible act and would show a lack of business foresight to create a debt which much be paid by future generations, without preserving to them the full value of the original investment. Yet, this provision is often thoughtlessly overlooked in the desire to make the money go as far as possible in new construction. Splendid roads have been built exhausting the funds available and then permitted to go to pieces long before the expiration of the bonds which built them. Unfortunately, the life of a road under modern traffic is not as long usually as the life of the bond issue. It would be a more equitable proposition if their durations were more nearly equal, but roads wear out long before the time of final payment unless preserved and protected by systematic maintenance.

For this reason bonds should not be issued for a period longer than the probable life of the contemplated improvement and preferably not to exceed 20 years. We have no moral right to impose upon succeeding generations a debt incurred for benefits which we alone receive and permit to expire instead of handing down intact to our posterity. It is related that a certain congressman who was criticised for voting to saddle a debt upon future generations, exclaimed, "What of it? What has posterity ever done for us?" He might have said with equal propriety, "What has it ever done to us to deserve such premeditated punishment?"

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[*] Address before the West Virginia State Road School, February, 1917.

[†] Supervising Engineer, Piedmont District Road Improvement, Piedmont, W. Va.; formerly State Highway Engineer of Idaho.

The character of bonds to be issued for road building is a matter that has not received sufficient consideration by local authorities contemplating this method of raising money. Until recently the long-term bond has been customary, regardless of whether the improvement was to be permanent or only temporary. Millions of dollars could have been saved if the form of bond known as the serial bond had been used instead. Under the serial plan, a certain amount of the bonds is retired each year, thus gradually reducing the interest charge to the county. Under the sinking fund plan, none of the bonds are retired until the end of a certain period and the total sum raised bears interest during the entire life of the bond. In addition to the interest payments there must be set aside, as a sinking fund, an amount sufficient to retire all of the bonds at maturity. Since the interest which the sinking fund draws on deposits is usually 3%, while the county has to pay 5 or 6% on the bonds, it is quite evident that the serial bond is much the cheaper. For instance, on a $100,000 issue of 20-year, 5% bonds, the saving in interest amounts to nearly $22,000 in favor of the serial plan. If it is not practicable to begin paying off a bond issue the first year of the loan, the first payment can be deferred until the fifth or sixth year in order to take advantage of an increase in taxable valuation by reason of development encouraged by the road improvement. In the above instance there would still be a saving in interest of about $13,000. The U. S. Office of Public Roads has recently published a very interesting and instructive bulletin of information gathered relative to the benefits and burdens imposed upon communities through the construction of improved roads by means of bond issues. Eight counties in five states, including New York, Virginia, Alabama, Mississippi and Florida, where bonds had been voted to build roads, were selected and a study of their experiences was made, covering a period of five years from 1909 to 1915. Three of the eight counties issued sinking fund bonds and five issued deferred serial bonds. Wise County, Virginia, issued $960,000 of 5% bonds running 30 years. Assuming that the sinking fund yielded 3%, the county could have saved $154,000 by the serial bond mehod, or even if 4% could be realized from the sinking fund, a saving of $72,000 would have been effected.

In the case of Dallas County, Alabama, $300,000 was issued payable in 30 years at 5%. Assuming the same earning rate of the sinking fund as in the above instance, the saving possible would be from $47,000 to $80,000.

Franklin County, N. Y., issued $500,000 deferred serial bonds at 5% running 30 years, but the first serial payment is not made until the 10th year. This bond issue has two distinct disadvantages; first, the bonds will long outlive the improvement; second, the first serial payment is too long deferred, thus allowing interest on the full amount to be paid for ten years.

The conclusions reached by the Office of Public Roads indicate that the most economical form of bond to issue is the deferred serial with the first payment at the end of the sixth year and the life of the bond limited to from 20 to 25 years.

Another point to which attention is called is the premature selling of bonds before the funds are actually needed, resulting in the payment of unnecessary interest. In one of the above counties, $5,000 was lost in this way. This detail of road finance should not be overlooked even though the saving be small. Waste in any form is to be condemned.

In the eight counties selected there was evident "a noticeable tendency on the part of county authorities to select and designate for improvement a larger mileage of roads than the funds contemplated were adequate to construct. Judging from these examples, it is quite obviously essential that where any county contemplates comprehensive improvements involving large outlays and expensive types of construction the detailed advice and estimate of a competent highway engineer be secured before the people are asked to approve a bond issue."

Relative to the economic benefits received by the above counties as a result of the improvement of their roads the report states that average hauling costs were reduced from 33.5 to 15.7 ct. per ton-mile, thus effecting an annual saving of $627,400, or $407,680 more than the annual cost for interest and retirement of principal of the bond issues.

Furthermore: "A study of the effect on the values of farm lands in the eight counties reveals the interesting fact that, following the improvement of the main market roads, the increase in the selling price of tillable farm lands served by the roads has amounted to from 25 to 194%, or from one to three times the total cost of the improvement."

These figures are not merely theoretical, but are taken from actual experience in practice. They not only afford a striking example of the wisdom of investing public money in the building of good roads, but they show that the real extravagance and waste of money comes in attempting to operate bad roads.

But to secure the best results in road improvement and the highest efficiency in the money expended, there must be good business management throughout, beginning with the preliminary investigation and planning for the construction and maintenance of the road system, under competent engineering supervision followed by efficient and economical management of finances. With these important features in competent hands, there is no question but that the borrowing of money to build good roads will prove to be fully justified and will pay liberal dividends on the investment.

Sale of New York State Bonds

Announcement has been made of the public sale of New York State gold bonds amounting to $25,000,000, at the office of the State Comptroller, Albany, April 5.

The bonds, it is stated, are to run for 50 years at 4%, exempt from taxation, and are legal investments for trust funds. They will be issued in coupon or registered form, in denominations of $1,000 for the coupon, and $1,000, $5,000, $10,000 and $50,000 for the registered bonds. The amount is distributed as follows: $10,000,000 for highways improvement, $10,000,000 for canal improvement, and $2,500,000 for development of the Palisades Interstate and Forest Reserve Parks.

Good Roads Day in Pennsylvania

Governor Brumbaugh of Pennsylvania has issued a proclamation fixing Thursday, May 24, 1917, as "State-wide Good Roads Day," and calling upon all citizens to do their share in making the day memorable in the forward movement of good roads.

In 1916, on Good Roads Day, 50,000 citizens of Pennsylvania devoted the day to work upon the roads. The use of 5,869 teams and 1,121 road drags was also given. Many women provided free lunches for the workers, and altogether the general spirit and willingness of the people to cooperate made the day a great success. Approximately 4,072 mi. of highways were treated.

Governor Brumbaugh asks the citizens of the state, as well as the supervisors of townships in the commonwealth, to give the entire day to work upon the roads, and if that is not possible to make contributions of money to local authorities, or furnish other means of lending cordial support to the movement.

Fifteen Million Dollar Road Bill Passed in New Jersey

The administration bill for improved roads, which provides for the raising of $15,000,000 in five years by the imposition of a direct state tax of 1 mill on the dollar against real and personal property, recently passed both houses of the New Jersey legislature and has received the Governor's signature.

The law takes the place of the Egan bill, calling for a bond issue of $7,000,000, which was accepted by the voters of the state at the last election, but which, it is stated, was impracticable. The Edge law, which supplants the Egan bill, provides for a comprehensive system of highways for New Jersey, but makes few changes in the routes designated by the latter, the principal changes affecting the routes to Cape May.

A companion measure, which has also become a law, reorganizes the State Highway Department with a commission of eight members, charged with the duty of putting the improvements through.

Governor Edge has appointed the Highway Commission as follows: John W. Herbert, Helmetta; Col. Anthony Kuser, Bernardsville; George W. F. Gaunt, Senate President, Mullica Hill; Col. E. A. Stevens, present Commissioner, Hoboken; Watson G. Clark, Tenafly; Walter J. Busby, Atlantic City; Ira S. Kipp, Jr., South Orange, and G. E. Blakeslee, Jersey City.

A bill has also been introduced in the legislature which confers upon the governor authority to appoint a general consulting engineer whose services will be available in connection with all engineering work undertaken by the state. It is understood that this bill is intended especially to permit the appointment of Colonel Goethals in that capacity.

Road Bill Passed in Missouri

What is known as the "Hawes Road Bill" creating a state highway commission of four members and providing for the revision of the road laws of the state, recently passed both houses of the legislature of Missouri, with a number of amendments.

The law provides for the acceptance of $2,500,000, the state's apportionment of federal aid, which, with revenue derived from automobile license tax and state appropriations, it is expected, will enable the state to construct 3,500 mi. of hard surfaced roads.

Good Roads Day at Macon, Georgia

The Good Roads Day of the Chautauqua of the South has been set by T. E. Patterson, Chairman of the State Highway Commission, for March 30, at Macon, Ga. An appropriate program is being arranged for the occasion. Invitations have been sent to Secretary of Agriculture David H. Houston, Senator Smith of Georgia and Senator Bankhead of Alabama. Dr. S. W. McCallie, State Geologist, Prof. R. D. Kneale and Prof. C. M. Strahan, of the State Highway Commission, and A. G. Batchelder, Chairman of the Executive Committee of the American Automobile Association, Washington, D. C., are expected to be present and make addresses.

Resurfacing of Roads in Daviess County, Kentucky

Plans and specifications for the improvement of pike roads radiating from Owensboro, in Daviess County, Kentucky, prepared by County Engineer J. W. Spurrier, cover the following named roads:

Livermore road, city limits to Park Ave., 1.7 mi.; material, broken stone; estimated cost, $3,641

Hartford road, city limits to end of old pike, 5.76 mi.: broken stone, $28,000; river gravel, $21,000; bank gravel, $18,000.

Leitchfield road, city limits to Dermot, a distance of 3.33 mi.; broken stone, $19,000; gravel. $16,000.

Calhoun road, city limits to Edgar Waltrip's farm, 3.29 mi.; broken stone, $17,000; gravel, $14,000.

River road from Hugh Herr's farm to the railroad, 1.46 mi.; broken stone, $4,000.

Henderson road from Calhoun road to William's farm, 2.6 mi.; broken stone, $10,000; river gravel, $7,000.

Hawesville road, city limits to Reid road, 2.56 mi.; broken stone, $7,457; river gravel, $6,141.

Twenty-two miles are included in the plans. Rock asphalt is recommended for the first few miles outside of city limits.

Iowa Road Legislation

Legislation affecting the future administration of state road affairs in Iowa has assumed the aspect of a controversy due to the presence of two measures—the Elwood bill and the Johnston bill—of widely opposing character. The essential differences in the proposed laws are as follows:

The Elwood bill retains the three highway commissioners as constituting the advisory department of road building, providing that the commission shall supervise the work of county supervisors, and, with county engineers, be subject to the Cosson ouster laws. The bill makes no provision for the issuance of bonds, but acquiesces in the present bonding system, and requires that 3% of the automobile tax fund be used for maintenance of the highway commission.

The Johnston bill provides for one highway commissioner, who is to act merely as an advisory officer, except in bridge building, authority in road building being given to the county supervisors, both to initiate and to supervise the work. The bill makes the commissioner answerable to the governor, who appoints him.

It prohibits the issuance of bonds for road and bridge improvement, and allows only $25,000 of the automobile fund for miscellaneous use.

Both bills provide for the acceptance of $2,000,000 of federal aid funds.

Motor Vehicle Legislation in New York

A second Hewitt-Wells motor tax bill, so-called, is before the legislative bodies of New York State. It relates to the limitation of dealers' demonstrations and the misuse of duplicate numbers. This measure, if enacted into a law, would become, according to the Motor Truck Club of America, "another burden upon progressive commercial growth." The first Hewitt-Wells bill was passed in January, as previously noticed in these columns. ["New Motor Truck Law Passed in New York State," "Good Roads," Feb. 10, 1917, page 105.] It provides for an increase of motor tax as applied to passenger omnibuses and auto trucks used for the transportation of goods, etc., on the basis, respectively, of seating capacity and combined weight of truck and carrying capacity.

A measure providing for the repeal of this law has been presented to the Albany legislature, sponsored by the motor truck interests.

Mower County, Minnesota, will build 102 new bridges at a cost of $200,000, according to recent advice.

The Recent Bond Election in Marion County, West Virginia, resulted in the issuance of $330,000 worth of bonds for highway construction in the Paw Paw district.

The Roads of Sangamon County, Illinois, are among the best in the state and are in excellent condition, according to a recent report. A plan to raise $10,000 for oiling the roads during the summer is under way.

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Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

MARCH 17, 1917.

EARTH ROAD MAINTENANCE

Especially timely are the suggestions on the maintenance of earth roads by F. L. Duffy of the Kentucky Department of Public Roads on another page of this issue. Mr. Duffy, who is Assistant State Highway Engineer of Kentucky and Secretary of the County Road Engineers' Association of that state, read the paper from which the extracts printed were taken at the 1917 meeting of the association at Bowling Green.

Within a few weeks it will be necessary to undertake spring work on several hundred thousand miles of earth roads in the country. Though apt to be overlooked in the efforts to provide paved highways of varying degrees of importance, the earth roads, as has been pointed out many times, still constitute the greater part of the country's road system. In many sections they are the roads from the farms to the market towns or shipping points, or at least are the feeders over which produce must be hauled to the roads of higher type radiating out from important centers. And while the individual earth road often carries only light traffic, the volume of travel over all the roads of this type is enormous. They are, therefore, of very great economic importance and deserve more attention than they often receive.

In the past, the work done on earth roads early in the season consisted chiefly of disturbing the traveled way and the ditches with a road machine. "Disturbing" is used advisedly to describe the process, for it accomplished little else. The road machine—a most useful piece of equipment if properly used, but a very destructive one if improperly employed—was sent out over the country roads, and sometimes over the village streets, in charge of men who knew little about road work. The machine was run down one side of the road with the blade set so as to gather up from the ditch all of the weeds, twigs, stones and other debris and bring them to the center of the traveled path. This operation completed on one side, it was repeated on the other and the road left to traffic. The results can easily be imagined by the few who may not be familiar with them from their own experience and observation.

The maintenance of an earth road is exceedingly simple in theory. There are, of course, certain seasons in which it is almost, if not wholly, impossible to keep a road of this type in usable condition, but during a large portion of the year it can be kept smooth and dry and in every way adequate to the demands of most of the traffic it has to carry. It is necessary only to provide for proper drainage and to keep the surface smooth and free from stones.

The drainage is perhaps more a matter of construction or reconstruction than of maintenance, for except the work that is done in keeping the ditches and existing culverts open and maintaining the crown of the road surface, comparatively little of the work of drainage can properly be classed as maintenance. If the drainage provisions on a given road are not adequate they can usually be very greatly improved by comparatively inexpensive reconstruction work. This will usually necessitate the redesigning and reconstructing of most of the drainage system, especially the culverts. It may also entail the installation of subsurface drains and perhaps a certain amount of relocation and regrading. If, on the other hand, the drainage was even passably well provided for in the original construction, a great deal can be accomplished by ordinary maintenance methods.

As indicated by Mr. Duffy, the road grader and the drag or plane are the necessary implements for earth road maintenance. Each of these, however, has its own particular uses and neither should be used for work requiring the other. It is generally necessary to reshape an earth road once or more during a season, and the grader should be employed for this. It should not be used to move the unsuitable material from the gutters to the center but to crown the traveled path and clean out and shape up the ditches, the material taken out being removed as far as possible from the roadway. This operation, if carried out intelligently, together with the necessary filling of holes, repairing of culverts, and similar incidental work, will put the road in such condition that during the remainder of the season it can be kept usable by means of the drag or plane.

So much has been written about the road drag that the uninformed have come to look upon it as a sort of panacea for all the ills of earth or gravel roads. It is not that, though it is a very valuable implement when used with discretion. Its function is to keep the road surface smooth and to maintain the contour once it has been formed by the grader or other implement. When used in this way, and used often enough and at the right time, it can be depended upon to keep the traveled path free from ruts and holes and to aid materially in keeping the road dry by so shaping the surface that the water will be shed to the ditches and carried away from the roadway.

There are various forms of drags from the so-called "split-log" draw to the well made machines of the drag and planer type. The split-log variety undoubtedly has its uses, but taking into account both durability and suitability for the work to be done the manufactured machines will generally be found the more economical in the long run as well as the more efficient. They can be obtained from dealers in road machinery and appliances, and are comparatively inexpensive.

In the last analysis the maintenance of earth roads is a matter of constant care. A little work at frequent intervals will keep an earth road in satisfactory condition for the greater part of the year and will yield as large returns in proportion to the expenditure of time and money as any work that is done on the highways.

Parker County, Texas, will hold an election on April 19 for the purpose of deciding upon a proposed bond issue of $250,000, the money to be used on highways in Road District No. 1.

Some Recent Developments in the Construction of Concrete Roads[*]

By WILLIAM M. KINNEY[†]

Because of the rapid increase in yardage of concrete pavements, little time or thought has been given by engineers or contractors until recently to the development of new ideas in regard to methods of construction. Those building pavements of this type for the first time have been satisfied to follow the methods of the pioneers, but the establishment of concrete as a paving material is developing an ambition to do work better and more expeditiously. This ambition has also been furthered to a large extent by the construction of concrete roads in larger units. Small jobs attract contractors with little equipment and the size of the contract does not justify additional purchases. But the passage of bond issues and the levying of higher taxes have permitted engineers and public officials to award contracts of sufficient size to encourage improvements in the art of road construction and in no part of road work has this been evidenced more than in the handling and hauling of materials.

Concrete road construction requires large quantities of bulky material that have to be hauled great distances over roads that are seldom suitable for heavy traffic. Although the original cost of an industrial railroad outfit to handle the materials for small jobs is prohibitive, this objection to that method of hauling is overcome as the yardage and the length of haul increase and its economy soon becomes apparent. Many influences affect the hauling of equipment. If teams are cheap they are usually most adaptable if the haul is short. For longer hauls, where the roads will stand up under motor traffic, the motor truck is used effectively. In like manner the tractor and train has its legitimate field. Each of these methods of hauling, however, has the disadvantage of destroying, to a greater or lesser extent, the roads over which the hauling is done and of cutting up the subgrade over which the loads are carried.

The latter consideration is most important and vitally affects the efficiency of the work. As the subgrade is usually rolled before the materials are hauled, ruts made by wagons or trucks are seldom filled as they should be before the concrete is deposited. This is particularly noticeable in inclement weather. The use of the industrial railway with cars of a suitable size to carry the materials required for one batch and of a type such that the material can be deposited directly into a side-loading mixer has much to commend it. The roads over which the materials are hauled are not rendered impassable, the subgrade is not cut up and the materials are kept clean and are not wasted.

Some may argue, and argue correctly, that on several jobs where this method of hauling has been used the costs have been high and the work unsatisfactory. These results have probably been due to one of two causes: Either the job was not large enough to justify the use of such equipment or else the crew was not properly organized. The mixer output and therefore the amount of road laid are dependent upon the regularity with which materials are supplied. Any breakdown of the hauling equipment means a large loss of time. In order, therefore, to insure uninterrupted operation, the crew supplying materials and the crew mixing and placing concrete must be well balanced. That this method of hauling has failed on some jobs is not a condemnation of the method, but rather of the organization.

On jobs where materials are placed on the subgrade, time and money can be saved by dumping them systematically on the work so as to reduce to a minimum the distance they have to be carried in wheelbarrows. This also applies to the storage of cement, for a uniform supply of cement at measured intervals on the road furnishes an accurate and easy check on the amount used.

Storage units for cement are also of advantage in that they provide protection for the cement in case of sudden rain. In such cases the pavement should be protected by canvas covers preferably supported on some type of framework. This will prevent pitting of the surface by the rain and the framework will prevent marks on the surface caused by placing the covers directly on the concrete. Frames have also been used to advantage for covering the concrete to prevent its too rapid drying out immediately after depositing. On one job where there was considerable rain the frame and canvas were arranged so as to permit the workmen to finish under the canvas even during a protracted storm.

The causes of certain defects in concrete pavement are not certainly known, but it is sure that an excess of water is responsible for many of them. Laboratory experiments have shown that the strength of concrete is greatly reduced by the addition of water beyond that amount necessary to make a workable mix; in fact it is stated on good authority that changes in the amount of water have as much effect on the strength of concrete as have changes in the amount of cement. This suggests the probability that future specifications will state not only the proportion of cement and aggregate to be used, but also the amount of water. Automatic devices for measuring or weighing the water for each batch are already in common use.

Closely related to the amount of water used, and quite as important in its effect on the strength of the concrete, is the time of mixing. The ingredients of concrete cannot be properly mixed in less than one minute and a longer period will usually be found well worth the extra expense. The time of mixing also has an important influence on the amount of water required, as continued mixing increases the plasticity with less segregation of coarse aggregate from the mortar. There are on the market several devices for measuring the mix. One of the simplest is the egg timer of the hour glass type, from which enough sand can be removed so that the balance will run through in one minute. This can be hung in a conspicuous place on the mixer and reversed as each charge is mixed. It can be seen by the inspector at a considerable distance. Other styles depend for their operation on time or number of revolutions. One of these makes it impossible to discharge the concrete until the specified time has elapsed.

Probably no new method of road construction has attracted more interest among engineers and contractors than the use of belts for finishing. Whenever the belt has been given a thorough trial the tedious process of finishing the pavement with hand floats has been abandoned. The belt finish produces a less irregular surface at a considerable saving in cost. The method as a practice has not yet been standardized, but the work which has been done indicates a preference for 3-ply or 4-ply belts from 8 to 10 in. in width. An 8-in. belt is used immediately after the concrete has been struck off and the wider belt is used for final finishing. The latter should be done as late as possible and still produce a surface of uniform texture. If final finishing is done too soon hair cracks will result, especially if the concrete is exposed to a hot dry wind. Applying the final finishing too soon also tends to draw excess water to the surface, thus producing a pavement which will wear quickly until the coarse aggregate is reached. Canvas-faced and rubber-faced belts as well as strips of ordinary tarpaulin have been used and the limited experience seems to favor rubber-faced belts because of their greater pliability. For the same reason canvas belts that have been used for some time are preferred to new ones.

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[*] Abstract of a paper presented at the 1917 annual meeting of the American Concrete Institute, Chicago, Ill.

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Some difficulty has been experienced in the use of belts on concrete in which stone screenings were used for the fine aggregate. Spots will frequently be left in the surface, which must be hand floated. The belt will probably be found advantageous in all forms of road construction, but its first use should be watched to make sure that an absolutely uniform texture is obtained.

As a belt produces no appreciable compacting of the surface, a strikeboard with which it is possible to do some tamping is recommended. This strikeboard should have a face about 8 in. wide and should be provided with long handles similar to those used on a plough, as the strain on workmen using a strikeboard of this kind is too great if they have to bend over to work. The use of the tamping strikeboard also makes possible the use of the drier mixture, as the tamping brings more mortar to the surface than the usual motion of the narrow strikeboard. Belts are particularly advantageous on pavements built without joints, for when belts are employed it is usually necessary to finish at the joints with a wooden float and steel trowel.

The striking and finishing of concrete on wide streets has made difficulties for some contractors and has influenced others to hesitate to bid on such work. The construction of a suitable strikeboard for wide streets and its proper operation at reasonable cost are difficult problems. During the past year there was built on Sheridan Road, Kenilworth, Ill., an excellent pavement on which the proper contour was obtained by hand work, using "lutes" or short strikes and working to stakes set at frequent intervals. This method does away with the inconvenience of using a long strikeboard and is of particular advantage on streets with varying crowns.

Considerable improvement in machines for concrete roads has been noted during the past year. The Baker machine has been used with success in Wayne Co., Mich. The objection to this machine that too wet a mix is required has been removed and the finishing machine is destined to play a more prominent part in the construction of concrete roads, it is probable that only by employing a machine of this type or of the Cowell type will it be possible to obtain the stiff mix so essential to the best results.

It is probable that ultimately we shall consider a consistency such as we now use too wet for the best results and will find it impossible to finish concrete of the desired consistency without some preliminary tamping by machines. For street work a vibrating machine of the type devised by R. C. Stubbs, of Dallas, Tex., may be found advantageous. This machine is operated over a flexible board mat placed on the newly laid concrete, and should permit the use of a comparatively dry mix.

The methods used for the installation of unprotected joints have, as a rule, not been satisfactory. A plank on edge is usually staked across the pavement, the filler is placed against the plank, and when concrete has been deposited on both sides the plank is withdrawn. This method is objectionable because it seriously disturbs the joint, often raising the filler from 1 to 3 in. from the subgrade and practically destroying its value. A device to overcome this difficulty has been developed and used successfully on several jobs. It consists of a light steel channel, or 2x8-in. plank, standing on edge and supported by the side rails a sufficient distance above them to allow for the crown of the pavement and ½ in. of joint filler extending above the pavement surface. To this channel or plank are bolted steel fingers extending below its lower edge for a distance equal to the thickness of the pavement, plus the crown and the projection of the filler above the pavement. These fingers are made of ½x⅜-in. strap iron and placed at intervals of from 12 to 18 in. An eccentric formed of ½-in round rods is placed opposite each alternate finger in such a way as to leave an opening when the eccentric is closed somewhat less than the thickness of the filler between the eccentric and the steel finger. The eccentrics extend through both flanges of the channel or through the plank and the upper ends are bent at right angles forming a handle by means of which they can be adjusted. The joint filler is placed between the eccentrics and the fingers, the eccentrics are closed and the device set in place. After the concrete has been deposited on both sides of the filler the eccentrics are loosened and the device withdrawn, leaving the filler undisturbed in place. The device should be set with the side on which the fingers are bolted facing the mixer so as to provide a backing for the filler until the concrete is placed against it. A filler having considerable rigidity is preferable for this device.

The curing of concrete pavements is an important matter. Plenty of water should be used and it should be applied as soon after the work is finished as possible. On hot, dry days the sprinkling of work placed in the morning can be commenced in the afternoon, and on almost all work sprinkling can follow on the next day after depositing the concrete. Curing by "ponding" is becoming popular in the localities where conditions will permit it. This method absolutely insures thorough curing and is destined to be used more extensively.

Oregon State Highway Commissioners Appointed by the Governor

The new State Highway Commission of Oregon has recently been appointed by the Governor, as follows: Third Congressional District, S. Benson, of Portland; Second Congressional District, W. L. Thompson, of Pendleton; First Congressional District, E. J. Adams, of Eugene.

The commissioners serve without pay, but are allowed their actual expenses. They select the state highway engineer. They will administer road work under the $6,000,000 bond issue if that carries at a special election called for June 4 next.

Comprehensive Plan for Street Improvement in Charleston, South Carolina

According to recent advices from Charleston, South Carolina, a large construction project representing the expenditure of approximately $500,000 on the streets of that city during 1919 is being planned.

A joint resolution was passed recently by the Legislature proposing to amend the constitution so that street improvement in the city may be decided upon without consulting the owners of abutting property. It is expected that this amendment will pass at the general election in the fall. Meantime comparatively little paving work will be undertaken, the efforts of the street department being devoted during 1918 to making surveys, preparing a schedule of streets to be improved, and other matters concerning materials and contracts.

Street Work in Philadelphia, Pennsylvania, Being Rapidly Advanced

The Bureau of Highways of Philadelphia, Pa., expects to have awarded before the close of the present month contracts approximating $1,500,000. This is a part of the plan of the bureau to spend $6,000,000 on streets, League Island Park, Northeast Boulevard and the Parkway.

On March 20 bids will be received through the Department of Supplies for the following: Gravel for the surface treatment of roads, about $40,000; gravel chips, about $13,000; motor distributors, about $60,000. It is planned to have the work and materials provided for by the $1,500,000 under way by April 15. During April contracts will be awarded for $500,000 worth of repaving, $300,000 worth of new paving, and $250,000 worth of country road work. The improvement of the Parkway from City Hall, it is expected, will begin July 1.

Unfinished work carried over from last year representing $1,500,000 will be started without delay. Miscellaneous work will involve the expenditure of $500,000, and $250,000 will be spent on emergency street repairs.

Road Work in North Carolina

The necessity of a state system of roads as well as county and township systems is urged in a booklet entitled "Some Facts and Figures About North Carolina and Her Natural Resources," recently gotten out by the North Carolina Geological and Economic Survey particularly for the use of the members of the 1917 General Assembly. The booklet also includes in the section devoted to good roads data on what has been done in the state and recommendations for road legislation.

During the past four years, according to the booklet, "There has been made available for road work approximately $21,620,000 (these figures are estimates, as the latest tabulated statistics we have at present are for 1914), of which $8,294,000 was raised by bond issues; $7,530,000 by special taxes; $3,691,000 is the estimated market value of the labor tax; and $2,110,000 is the estimated value of the convict labor employed on the public roads during this period."

The total expenditure for road construction during the past four years is placed at $12,935,000, while $8,691,000 has been expended for the maintenance of earth roads. The results, it is stated, have not yielded what they should have and it is due, according to the booklet, to the following:

"A lack of system and method in the administration of road funds;

"Lack of expert engineers to take charge of the location and construction of the roads;

"Lack of uniformity in county road laws;

"Present inadequate methods of maintenance, showing futility of the use of a labor tax;

"Need for closer cooperation between county and state officials;

"Lack of general state and county plans for systems of highways;

"Lack of legislation in regard to width of tire to be used on public highways, an important factor in maintenance;

"A tendency to make the unit of government too small in the issuance of bonds. It is believed that the best results can be achieved from a county bond issue."

The suggested legislation to remedy the defects in the present method of administration is included under two heads—state and county. These recommendations are as follows:

State.

"1. Increase in the fund for the support of the State Highway Commission to at least $75,000 per year.

"2. The establishment of a fund for the maintenance of state highways. It is believed that the automobile tax should be used for this purpose.

County.

"3. Passage of a general law relating to the issuance of bonds by counties or townships, embodying the following points:

"(a) Define amount of bonds which may be issued in relation to assessed value of property in the county.

"(b) Define rate of tax sufficient to cover interest and sinking fund on bond issue and provide funds sufficient to insure the systematic maintenance of the roads to be built by the bond issue. This latter provision is considered most essential.

"(c) Provision that the roads on which the bond issue is to be expended must be properly located by a competent engineer approved by the State Highway Commission.

"4. Use of all able-bodied state convicts in the construction of state highways.

"5. Have a uniform county road law embracing the following points:

"(a) Have in each county a road commission, non-political, the members to be chosen because of their integrity and business ability.

"(b) Provide that the roads to be built by the county out of a bond issue, or other funds, shall be located by the State Highway Engineer, or an engineer approved by the State Highway Commission.

"(c) Provide for the organization of the road forces of the county on a systematic basis, having for a road superintendent a man whose ability for such an office would meet with the approval of the State Highway Engineer, to whom he would be responsible for the quality of work done.

"(d) Provide that bridge construction shall have the plans and specifications approved by the State Highway Engineer, and the final award of contract for bridges to be approved by the State Highway Engineer.

"(e) Provide an annual tax sufficient to inaugurate a system of maintenance not only for the surfaced roads, but for the dirt roads of the county, and for the organization of maintenance forces according to plans approved by the State Highway Commission."

Pavement Construction in Berkeley, California

Information regarding pavement construction in Berkeley, Cal., during 1916, covering approximately 2.25 mi., the contracts that have been awarded for 1917 work, and other paving that will probably be done during the year is furnished by J. J. Jessup, City Engineer of Berkeley. The kinds, amounts and costs are shown in the following table:

During 1916 the city laid 6,140 lin. ft. of concrete curb, at 40 ct. per lin. ft.; 780 sq. ft. of gutters at 14 ct. per sq. ft.; and 13,800 lin. ft. of combined curb and gutter, 2 ft. wide, at 50 to 58 ct. per lin. ft.

Kind—	Sq. Yd.	Base.		Surface.		Cost: Foundation and Surface. (per sq. yd.)	Total Cost.
		Thickness. (in.)	Mix.	Thickness. (in.)	Mix.		
Asphalt, Topeka Mix	36,660	5	1:3:6	2	.....	$1.15 to $1.20	$61,400
Bitulithic	23,900	6	1:3:6	2	.....	1.40	40,700
Concrete	9,100	..	.....	5	1:2:4	1.30 (on hillside)	15,700

On 1917 construction the city has awarded contracts amounting to about $169,600. The contracts call for 72,000 sq. yd. of asphalt pavement, Topeka mix, and 24,500 sq. yd. of bitulithic, each with a 6-in. base and a surface course 2 in. in depth, at $1.26 and $1.45 per sq. yd., respectively.

It is probable that the city will lay during 1917 additional paving in the following amounts: Topeka, 45,000 sq. yd.; bitulithic, 40,000 sq. yd.; monolithic brick, 7,000 sq. yd.

Johnson County, Tennessee, at a recent election, passed a bond issue of $200,000 for road purposes by a majority of 400 votes.

A Complete Maintenance System in Grayson County, Texas, will shortly be put into effect on the entire road system of the county on which $1,750,000 has been spent.

MEETINGS

Calendar of Coming Meetings

March 27-30.—Ontario Department of Public Highways—Annual conference of County Road Superintendents and Engineers, Parliament Buildings, Toronto, Ont.

April 10-14.—Dominion Good Roads Association—Fourth Canadian and International Good Roads Congress, Horticultural Building, Ottawa, Ont., Can. Secretary, Geo. A. McNamee, 909 New Birks Building, Montreal, P. Q.

April 16-18.—Portland Cement Association.—Spring Convention, San Francisco, Cal. Secretary, F. L. Page, 111 West Washington St., Chicago, Ill.

April 17-20—U. S. Good Roads Association.—Fifth annual convention, Birmingham, Ala. Secretary, J. A. Rountree, 1021 Brown Marx Building, Birmingham, Ala.

May 7-9.—National Conference on City Planning—Annual Conference, Kansas City, Mo. Secretary, Flavel Shurtleff, 19 Congress St., Boston, Mass.

June 11.—New York State Conference of Mayors and Other City Officials—Annual Conference, Buffalo, N. Y. Secretary, W. P. Capes, 25 Washington Ave., Buffalo, N. Y.

June 26-30.—American Society for Testing Materials.—Annual meeting, Atlantic City, N. J. Secretary, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

PUBLICATION

A TEXT BOOK ON BRICK PAVEMENTS. By Clark R Mandigo, A.B., M.C.E. Cloth, 5x7½ in., 126 pp., illustrated. Published by the Western Paving Brick Manufacturers' Association. $1.50.

This book, according to the announcement of the Western Paving Brick Manufacturers' Association, has been issued for "the education of the public in the characteristics and proper construction of vitrified brick highways and city pavements." It includes besides six chapters on the construction of brick pavements an appendix containing the standard specifications of the Western Paving Brick Manufacturers' Association. The chapter headings of the text are as follows: Brick Pavements—Highway Economics—The Subgrade and Foundation—Manufacture of Brick—Laying the Brick—Paving Problems. The book is printed on paper of especially good quality and is profusely illustrated by full page and smaller halftones and line drawings consisting of reproductions of photographs of brick pavements under construction and completed, bridges and culverts, brick plants and brick making machinery, and other subjects.

PERSONAL NOTES

H. D. Forneri has resigned as City Engineer of Eugene, Minn., and will enter practice as consulting engineer in San Diego, Cal.

G. C. Brehm, Borough Engineer and Street Commissioner of Waynesboro, Pa., has been appointed City Engineer of Marlboro, Mass.

C. I. Felps, formerly Assistant Engineer, Office of the State Engineer of Kansas, has been appointed Field Engineer of the Portland Cement Association, with headquarters at Wichita, Kan.

T. C. Richardson, formerly United States Inspector at Vicksburg, Miss., is now Highway Commissioner of Washington County, with headquarters at Glen Allan, Miss. Mr. Richardson has charge of the construction of 35 mi. of the 150 mi. of concrete roads which the county is building.

George Henry Frost, founder of the "Engineering News," died of pneumonia at his home in Plainfield, N. J., on Thursday afternoon of this week. Mr. Frost was born in Ontario and was a graduate of McGill University. He was a land surveyor and later a railroad engineer, and in 1874 founded the "Engineering News," which he published until 1911. Mr. Frost, who was 79 years old at the time of his death, was a member of the American Society of Civil Engineers and of the Canadian Society of Civil Engineers, and an honorary member of several state engineering societies. He is survived by a widow and four sons.

NEWS NOTES

Cass County, Michigan, will vote on a proposed bond issue of $300,000 at the coming April election, according to a report.

The Yellowstone Highway from Cheyenne, Wyoming, to the eastern entrance of Yellowstone National Park has been marked and greatly improved. The route of the highway is through Wheatland, Douglas, Glen Rock, Casper, Thermopolis, Basin and Cody, Wyoming.

A Fifty-Year Old Wooden Bridge across the Volga River at Mederville, Clayton County, Iowa, is being removed to make way for a new structure which is to be 500 ft. long, and will cost $16,000.

Jersey City, New Jersey, opposed the passage of the new state highway bill in New Jersey, claiming that the city would thereby be assessed $315,000 a year for five years without receiving any direct returns from the expenditure.

The Legislature of Kansas recently passed four measures relating to highways, the principal one providing for the creation of a state highway commission to direct the expenditure of $6,000,000 during the next two years, including $800,000 of federal aid.

A Movement for the Construction of a Military Highway on the Pacific Coast, extending from the Canadian line to the Mexican border, has been started by the Pacific Coast Defense League, of Olympia, Wash., which is said to have the support of the legislatures of Oregon, Washington and California.

The Joint Road and Bridge Committee of the Minnesota Legislature is the author of a measure proposing that the state appoint a single state highway commissioner, instead of several, at a salary of $4,500. He would be required to give a bond of $25,000, and would have control over all state road work.

More Actual Work on the Lincoln Highway will be done during 1917 than ever before, according to officers of the Lincoln Highway Association. For that reason, it is stated, it will be necessary for travelers using the highway in the approaching tourist season to make detours where road improvement is going on.

The Repaving of Broadway between Vesey and 14th Sts., New York City, at an early date has been announced by Borough President Marks. It is stated that past experiences in repaving streets beneath which subways have been built have indicated that the best and cheapest pavement for the present construction, outside of track area which is on solid foundation, is sheet asphalt over the present granite blocks.

Los Angeles County, California, has recently completed a steel highway bridge across the Santa Clara River on the main valley route from Los Angeles to San Francisco. The length of the main span is 200 ft., the plate-girder approach at each end being 35 ft. long. The structure which was designed by H. E. Warrington, County Road Engineer, and F. H. Joyner, Road Commissioner, was built at the request of the California State Highway Commission, and becomes a part of the highway system of the state.

EQUIPMENT — TRADE — MATERIALS

Metropolitan Paving Brick Company Purchases the Bessemer Paving Brick Company

Officials of the Metropolitan Paving Brick Company, of Canton, Ohio, have announced the purchase of the brick interests of the Bessemer Limestone Co., of Youngstown, O.

By the terms of the purchase, the Metropolitan Paving Brick Co. has acquired the large brick kilns of the Bessemer Company at Bessemer, Pa., and hundreds of acres of paving brick shale. The purchase has been under consideration for several months, the Metropolitan Paving Brick Co. having taken charge of the additional plant on March 1.

The general office of the company will remain at Canton, O., as previously.

Tar-mac Specifications

An attractively printed folder comprising specifications for the use of Tar-mac is being distributed by the American Tar Products Co., of Chicago, Ill.

The folder consists of seven sheets and cover bound in the usual manner of specifications and contains the following: Specifications for treating macadam roads with Tar-mac A; specifications for Tar-mac filled macadam; specifications for resurfacing old macadam roads with Tar-mac T; and specifications for Tar-mac mixed macadam.

The folder is printed in red and black on white paper with a blue cover with white lettering and a red and white trademark.

Notes

The E. A. Lord Construction Co. has moved its headquarters from Rock Island to 320 South Third St., Monmouth, Ill. The company does a general construction business, specializing on road building.

The sale of over $4,000,000 worth of Packard motor trucks during January and February has been announced by the Packard Motor Car Co., Detroit, Mich. It is stated that these sales include a few orders from the U. S. Army, but none from foreign military establishments. The large volume of sales is regarded by R. E. Chamberlain, Manager of the Truck Sales Department of the company, as indicative of prosperous conditions in general business.

The Duplex Truck Co., of Lansing Mich., has recently issued a 14-page booklet, 9x12 in. in size, with covers, on the Duplex 4-wheel drive, 3½-ton truck, made by that company. In this booklet the design and construction of the truck are fully explained in such a manner as to be interesting to read and easy to understand. The separate parts of the truck are distinctly shown in half-tone illustrations. Diagrams and specifications for body builders are also included.

"Your Streets" is the title of a booklet being distributed by the Editorial Bureau of the Portland Cement Association, Chicago, Ill. The booklet is 6x9 in. in size, and consists of 34 pages and covers. On each left-hand page is a group of illustrations showing concrete pavements in various cities, while on the opposite pages is matter describing the advantages of concrete as a paving material. There are also included statements by city engineers and other city officials giving the results of their experience with concrete pavements. On the covers are groups of illustrations of concrete pavements.

The Dunn Wire-Cut Lug Brick Company of Conneaut, O., announces the addition of the Albion Shale Brick Co., of Albion, Ill., to its list of licensees. This addition brings the number of licensees to 44 companies operating 69 plants in 12 states.

Sullivan & McGrane, contractors for asphalt pavements and plants, have removed their business offices from Somerville, Mass., to 294 Washington St., Boston, where their future business will be conducted. The Somerville office will be retained.

At a meeting of the directors of the Granite Paving Block Manufacturers' Association of the U. S., Inc., held at the Hotel Belmont, New York, N. Y., on Feb. 27, directors were elected as follows: F. T. Mason, Atlanta, Ga.; Thomas Lahey, C. Harry Rogers, Boston, Mass.; Thomas Woodruffe, Mt. Airy, N. C.; James Adamson, William Booth, H. S. Lanpher, Joseph Leopold, New York, N. Y.; F. A. Wallenborn, Salisbury, N. C.; H. E. Fletcher, West Chelmsford, Mass.; D. L. McLaren, Westerly, R. I.

NEWS NOTES

Cherokee County, Iowa, by its Board of Supervisors recently awarded contracts for 125 bridges and culverts to be constructed during 1917. The total estimated cost of the work is $117,863.

A Campaign is Being Conducted in Scott County, Missouri, for the improvement of 190 mi. of main traveled roads at a cost of $950,000. The necessary funds are to be raised by direct taxation.

The Court of Errors and Appeals of Jersey City, New Jersey, has annulled the contract awarded to William Baker, Inc., of that city for paving Newark Turnpike with wood blocks. The amount of the contract was $487,000. A new call for bids will be issued later by the Board of Freeholders.

The Board of Public Works of Davenport, Iowa, has announced that general paving activities in that city will be resumed by April 2, and unfinished 1916 contracts amounting to $72,000 started on the way to completion. It is expected that Davenport will spend $250,000 on paving and repairs during 1917.

Under the Roads Bill Passed by Oklahoma recently, the state will be able to build about 25 mi. of improved highway at an estimated cost of $10,000 per mi. The apportionment of federal funds to the state for this year is $115,000, which, with the same amount from the state, will provide for the construction of the above mileage it is reported.

New Concrete Roads in Wayne County, Mich., must be built with a width of not less than 16 ft., or 24 ft. over all; 18 ft. and 20 ft. widths to be adopted whenever practicable. This has been decided upon by the County Commissioners, who find there is a large diversion of traffic to a newly opened concrete road, and it is stated that the increased cost of the wider roadway will be overcome by a saving in money paid for maintaining the shoulders of the narrow road.

Bond Issues in Ten Counties in South Carolina have been authorized to the amount of $4,398,064. In Spartanburg, McCormick and Pickens Counties the bond issues are authorized by an act of the legislature. In the seven other counties the question is decided by a vote of the people, and elections will be held as follows: Chester County, March 27; Laurens County, March 27; Union Township, Union County, March 20; Colleton County, not later than April 3; Beaufort and Charleston Counties not later than Nov. 1.

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Highway Work in New York State in 1916

What has been accomplished in road construction in New York State during 1916—a resume of the general road situation in the state together with recommendations for the conduct of future work—is presented in the annual report of Edwin Duffey, New York State Commissioner of Highways, for the year ending Dec. 1, 1916. The following is taken from the report.

On Jan. 1, 1916, the total mileage covered by contracts in force for state and county highways was 1,185, of which 783 mi., including reawarded contracts, remained to be constructed. During 1916 contracts were awarded for 667 mi., making a total of 1,450 mi. to be built. There were completed and officially accepted 508 mi., and an additional 55 mi. were completed but not in time for acceptance, leaving 887 mi. of actual mileage under contract and not completed Jan. 1, 1917.

The total designated mileage of state and county systems in New York is 11,988, of which 5,926 mi. were completed and accepted Jan. 1, 1916. The contracts in force at that date, covering 1,185 mi., as has been stated, and the contracts awarded in 1916 left a balance of designated mileage of 4,210.

Many of the large number of contracts in force at the opening of the construction season of 1916 were held by inexperienced contractors who had taken the work at figures based on the cost of labor and materials for the preceding year. It was impossible to secure, even at greatly increased cost, more than approximately one-fourth of the total amount of labor required. This shortage of labor and its increased cost, together with the increased cost of materials and supplies, were largely responsible for the failure of a number of contractors and the subsequent abandonment of their contracts. Despite the repeated and urgent efforts of the State Commission of Highways, the unusual economic conditions not only materially hindered the work, but occasioned an unavoidable increase in the cost thereof, with the result that the amount of road mileage completed during 1916 fell short by about one-half of the mileage completed during 1915.

In 1906 and again in 1912 a bond issue of $50,000,000 was authorized for road purposes, making a total of $100,000,000

JASPER-ADDISON HIGHWAY, STEUBEN COUNTY, N. Y.—WATER BOUND MACADAM PAVEMENT—TOP COURSE, SLAG AND LIMESTONE SCREENINGS.

available for road improvements during a period of 10 years. Of the latter issue, $15,000,000 remained unappropriated on Jan. 1, 1916. The unexpended balance of the former issue was obligated by existing contracts or expedited routes.

STATE HIGHWAY NO. 5350, BATH VILLAGE, STEUBEN COUNTY—14-FT. BRICK PAVEMENTS AND 12-FT. CENTER PARKWAY.

The total appropriations for the 667 mi. of state and county highway for which contracts were let during 1916 were as follows: State, $6,902,930.01; county, $2,321,029.99; village, $621,550.00; total, $9,845,510.00. The price of labor and materials in 1916 being largely in excess of the price prevailing prior to that time, the department was obliged to advance its estimates accordingly.

There are now in force contracts aggregating 935 mi. This, with the usual maintenance and repair work, will apparently absorb most of the available labor supply if conditions remain unchanged throughout the year.

In the acceptance of federal aid under the recent act several questions are presented for consideration. The highways of the state are divided into four classes: State highways, the total cost of whose improvement is paid by the state; county highways, at least 65% of the cost of which is paid by the state, and the balance by the county; town highways, or earth roads, constructed at the expense of the town plus money contributed by the state; and county roads, constructed jointly by the counties and the towns. The maintenance of state and county highways is borne entirely by the state, except that each town contributes $50 annually for each mile contained therein. The town highways are maintained by the towns. The county roads are maintained by the towns, or by the counties and towns, in the discretion of the board of supervisors.

On Jan. 1, 1917, the total number of miles of state and county highways completed and accepted, or under contract, was 7,788, leaving a balance of 4,210 mi. in the combined systems, for which no funds are available. The unappropriated $15,000,000 remaining from the second bond issue will be insufficient to complete the state and county system. No other funds are available for the purpose. It is clear from a careful study of the road map of the state that with federal aid moneys properly expended an additional mileage of the designated system could be constructed to give a connected system of both state and county highways, improving virtually every main thoroughfare in the counties, connecting the county systems, every village and practically every hamlet, and rendering the mountain and park reserves accessible.

The town highways and county roads, even at the present time, afford a great and extensive auxiliary system to the state and county highways, and the two systems if constructed as suggested would give the state a network of improved roads equal to all demands even under the rapidly increasing traffic.

The New York State share of federal aid apportionments together with appropriations made by the state to meet it aggregate a total of approximately $8,000,000, which will provide for the necessary mileage to complete the system of state and county highways. The specific allotments of federal funds to the state are as follows:

Year ending.	Amount.
June 30, 1917	$ 250,720.27
June 30, 1918	501,440.54
June 30, 1919	752,160.81
June 30, 1920	1,002,881.08
June 30, 1921	1,253,601.35
Total	$3,760,804.05

The acceptance of the first apportionment, $250,720.27, for 1916-1917, carries with it the obligation on the part of New York State to meet this with an equal amount. Rejection either by definite act or by failure to comply with the requirements of the federal act will prevent the state from receiving any part of the $75,000,000 which represents the entire appropriation under the act for the 5-year period. The requirements of the federal aid law. while fair and reasonable, are such as to render it impracticable to use bond issue moneys for the state's share of the cost of conducting the work of improvement in conjunction with the United States Government. This is especially true in regard to the improvement of county highways, in which the county authorities have an active share, and for which the greater portion of the remainder of the bond issue moneys will be required. An equally potent reason is the great advantage to be derived from the additional mileage to be obtained in places where it is greatly needed, not for local purposes merely, but for state wide advantage, and which cannot otherwise be had. In many sections of the state uncompleted gaps exist in the systems of state and county highways designated for improvement. The money allotted to those sections from the bond issue have either all been expended, or will be insufficient to complete these gaps. The utility of the whole route is greatly diminished by the existence of these gaps. No other state moneys except those provided by the bond issue are now available. Unless direct appropriations are made for the state's share of the federal aid work, it is obvious that no improvement could be made in the very places where most needed to complete through routes.

The funds required for the improvement of county highways are derived from two sources: sale of the second $50,000,000 bond issue and apportioned to the counties, and money contributed by the counties. Prior to 1916, Section 141 of the Highway Law provided that the county should pay 2% of the cost of a county highway for each $1,000 of assessed valuation for each mile of public highway within the county, the state paying the balance; but in no case could the county pay more than 35% of the total cost. The Legislature of 1916 authorized a board of supervisors to provide for the payment of 50% of the total cost of a county highway. Of the 50% thus paid, not more than 15% is borne by the town or towns within which the road is located, and the balance by the county.

It is obvious that the adoption by a county of the proportion of payment so authorized increases the amount of county highways which may be improved in such county by state aid, and the adoption by all counties of this basis would result in the improvement of another substantial portion of the designated system of county highways.

The Legislature of 1916 appropriated $50,000 for use in the employment of convict labor in the improvement of roads other than those to be improved as state or county highways under the bond issue.

In order to secure cooperation in this work the local authorities have been required to furnish a camp site, free of charge, road building machinery, road making material, and a donation in money, either from town funds or by private subscription, the amount of the donation varying, according to conditions, from $500 to $5,000 per road, depending upon the class and quality of the road to be built. The total contributions thus made aggregate approximately $16,000. Nine different projects were taken up for improvement, the roads being those selected by the State Highway Department. The convicts employed were taken from the prisons most accessible to the roads upon which the work was performed. The convicts were also employed in the work of maintenance and repair of state and county improved highways, under the law authorizing their use for that purpose, the cost of maintenance being taken from the regular appropriation for maintenance and repair of improved highways.

About 16% of the average population of Great Meadow Prison was employed on road work during the summer season; about 6½% from Dannemora Prison; about 13% from Auburn Prison; and about 1½% from Sing Sing, making about 9% of the total population of the four prisons employed during the season.

This is the first time in the history of the state that this work has been carried on to such an extent and with such satisfactory results. The character of the work performed has been highly satisfactory, the new roads which have been

PARK ST., SYRACUSE CITY, HIGHWAY NO. 5477, ONONDAGA COUNTY—COMPLETED PORTLAND CEMENT CONCRETE PAVEMENT.

built being ample for the localities and the traffic which they receive. No complaints have been made by citizens living in the vicinity of the camps, and with the exception of some minor cases of disobedience it may be said that the discipline was well maintained. The improvement in the physical welfare of the men was very noticeable, and as many of the convicts were short-term men, and their period of imprisonment was soon to expire, they were enabled to obtain employment immediately and become self-supporting, due largely to their improved physical condition. Encouraging as the results have been the experience of the past year will be of great aid in attaining more satisfactory results in the future.

In 1916 the department for the first time prepared and issued, on May 15, a map showing all of the state and county highways already constructed and the improved county roads and town roads. Its usefulness to the traveling public has decided the department to issue a similar map this year, adding all of the mileage ready for use up to May 1.

In this connection, attention is called to the fact that many of the counties and towns in the state have been and are now building roads at their own expense. These improved county and town roads, which act as auxiliaries to the main system of improved state and county highways, exceed in mileage the total mileage of such improved state and county highways built by state aid. While adequate for the traffic for which they were designed, the roads are generally of a lighter type than the state and county highways and their life is seriously imperiled by the imposition of the kind of traffic referred to above.

Motor traffic is increasing with such rapidity that it seems clear that something should be done by the present legislature in the way of enacting laws for such regulation, or by amending the existing laws which in their present form are inadequate. (The Hewitt-Wells Motor Truck Tax Bill became a law Jan. 30, 1917.)

NEW ROCHELLE-MAMARONECK HIGHWAY NO. 5372, WESTCHESTER COUNTY—2-IN. BITULITHIC PAVEMENT ON A 5-IN. CONCRETE BASE; WOOD BLOCK STRIPS AT RAILS.

The problem of the maintenance and repair of the system of improved state and county highways is in some respects more complicated and difficult at this time than heretofore. During the past season 170 contracts were awarded for reconstructing, resurfacing, etc., aggregating $2,180,872. In addition there was expended for labor and material on work done by the department forces, $2,112,830, making the total expenditure during the year 1916 17 for maintenance and repair of completed and accepted state and county highways $4,293,702.

In 1898 the state aid law was passed providing for the improvement of town highways, which would become auxiliaries to the main systems of improved highways. Under this plan 10,685 mi. of town highways have been improved, divided as follows: Macadam, 4,483; gravel, 6,190; concrete, 12 miles. Though not of the high type of construction of state and county highways, they are adequate for the purpose intended, viz., as auxiliaries to the main system. The mileage exceeds that of the combined state and county system

The experience of the Highway Commission is that the highways of the state under its charge are yearly requiring an increased amount of maintenance and upkeep, due partly to the increased mileage and partly to the heavier traffic which they sustain. Much of the maintenance cost is occasioned by the severe use to which the roads are subjected by motor trucks and motor omnibuses. A considerable portion of the improved roads of the state was constructed before this heavy traffic appeared. Such traffic is becoming heavier each season, and it is of the utmost importance to the state, if the large investment it has already made is to be properly conserved, that some well defined and reasonable regulations be prescribed. The evidence obtained by the commission upon which to establish registration fees showed that the makers and users of motor trucks and motor omnibuses recognized the need for such proper regulations and offered to cooperate in bringing about such a result.

and is increasing at the rate of 800 to 900 mi. per year. The total amount available in 1916, in 932 towns, for highway, bridge, machinery and miscellaneous purposes was $9,295,278. Of this amount $3,500,000 was raised by taxes levied and collected on property outside of cities and incorporated villages, in order that the towns might secure from the state a contribution from the general treasury of $1,950,575. The cost to each taxpayer is 16.8 ct. for each $1,000 of taxable property.

The mileages of all types of improved roads throughout the state on Jan. 1, 1917, were:

	Miles.
State and county highways	6.434
Town highways	10,685
County roads (Sec. 320, 320a)	575
County roads (Special acts)	521

The total of the so-called public highways in New York is 79,398 mi. This includes every description of road, many being little better than by-paths or lanes. It is estimated that the major portion of the traffic throughout the state is now borne by approximately 61% of the total mileage; in other words, the total mileage of generally used roads would not exceed approximately 50,000 mi. and 36% of this mileage has been improved.

An appropriation of $5,000,000 from the bond issue funds is asked for 1917 highway work. Careful consideration of the plan of federal aid in view of the fact that it must be met by a special appropriation outside of bond issues is recommended, as is legislation permitting a broader use of convict labor on the roads of the state.

A Duty of Highway Commissioners and Highway Engineers as Public Officials[*]

By JOHN J. COX[†]

Each year, at this meeting, we have been told and we have discussed the duties of highway commissioners and highway engineers under the law. I wish to speak of the duty of these officials not prescribed by law, but yet a duty that should be assumed by both commissioners and engineers—a moral duty, or, if you please, a business duty; one that is theirs as the business representatives under a republican form of government.

Theoretically, after a man is elected to an office and placed in charge of the business of the public we concede without debate that he is not only there for the purpose of doing this business as laid down by the laws of the state, but also to look after the interests of the public, whatever they may be, relating thereto or rising out of that office. I look at an officeholder as a business manager in charge of a particular line of business belonging to the public. If this man is a business manager and he studies the public problems presented to him because of his office, he should know more about his part of the public's business than the public itself. It follows, then, that in order to do justice to the public—his employer—he should carefully plan and formulate and lay out the scheme for the conduct of this particular business. Not only that, but he should endeavor to be the one to see that this scheme is kept up-to-date and workable at all times. In fact, he should be the leader for the public in this particular business. He should direct the efforts of the public along proper lines so that dangerous and costly pitfalls can be avoided. He should take a definite stand against any proposition, regardless of where it originates, that does not insure greater efficiency in the public's business or service. If he does not, I think you will agree with me that he is a poor officeholder.

If we accept this general view as properly representing the moral or business duty of highway commissioners and highway engineers, and then proceed to analyze the methods used in conducting the public's business of building and maintaining roads in Michigan, we are confronted with some embarrassing questions. Often the correct answers to these questions are not very complimentary to our ability as officeholders. At other times, we have to admit that we are followers, not leaders, in the very business in which we have specialized and are supposed to be directing.

For instance, are you, as highway commissioners and highway engineers, from your knowledge of road building, road maintenance, and local conditions, directing the layout of the road system under your jurisdiction, or is it being done by special interests or by the public, on a 15-minute consideration?

Are you selecting the foundations and wearing surfaces for your roads, after giving due consideration to all of the factors entering therein, or are they being selected by companies interested in the sale of materials to be used in the construction of these roads—companies who by extensive advertising campaigns, and, in some cases, misrepresentation, have enlisted the aid of a large majority of the public to assist them in selling their manufactured product?

Are you planning and organizing for construction and maintenance so that the business of road improvement in your community will progress steadily and efficiently and so that a maintenance organization will be developed that will balance the demands caused by construction and traffic, or is this planning and organization being done by special interests or by the public which is not informed as to what is best for its own interests?

Are you having anything at all to say about the amount of money that should be raised each year in your community for the improvement of roads? Are you, with your knowledge of road building, assisting the public in the solution of their problems of finance, or are you also leaving this to special interests?

There are many other questions that could be asked that would be equally as embarrassing to answer, but for the purpose of this paper these will suffice.

Take the question of layout for a system of roads: Under the township organization we can hardly say that such a thing as system ever existed in Michigan. Under the county organization, up to the present time, we have had promise of good results. Almost all of the counties, after adopting the county road plan, laid out a good system of roads. These systems were laid out, in most cases, so that when completed they would serve the needs of each particular county. Not many cases can be cited where special interests or the public have interfered in the layout of these systems. With the passing by the state legislature of the Covert Act, in 1915, we had injected into the problem of improving roads a bad influence. The general tendency of this act is away from any system. Of course, this tendency is supposed to be held in check by the county road commissioners and county highway engineers, but I submit to you whether this has been done in a satisfactory manner in a large number of cases.

In 1913 the state legislature set a bad example in the layout of a system of trunk line roads in this state. With very little study and consideration, it named approximately 3,500 mi. of highway as trunk line roads; then offered double reward on these roads, as an inducement to have them built. The saving feature of this act was that naturally the large part of the road mileage provided for fell on the main roads already adopted and designated as county roads in the counties operating under the county road plan. This method of laying out roads cannot be recommended.

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[*] Address at the Short Course in Highway Engineering at the University of Michigan, Feb. 19-23, 1917.

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As to the question of selection of foundations and wearing surface, are you, as highway commissioners and highway engineers, making this selection, or are you leaving it to the judgment of the public and the political manipulation of special interests? I think you will have to agree with me that quite a large mileage of the roads to be built in Michigan next year has been selected by special interests, with the cooperation of the public. In fact, we are now confronted with a condition in this state, in the building of roads, that is very similar to a condition that existed some years ago in the construction of city pavements in a number of cities—a condition wherein the selection of the kind of road and pavement to be constructed depended entirely upon the political activity and political strength developed by the various interests selling road surfacing materials. The history of these cases in the past is filled with examples of bribery and graft. I hope that the road conditions in this state, through the efforts of you highway commissioners and engineers, will be spared such dishonesty, extravagance and waste as was suffered in the past by the cities.

There is no doubt but that we shall have considerable waste and many miles of poor roads before the movement that has started in this direction can be stopped. Already several large bond issues have been approved by the people, and I know of at least two more that are up to the vote of the people in the April election that, I am convinced, were designed and prepared by special interests. The end of this kind of road construction is not yet in sight.

As to the question of the selection of foundations and wearing surfaces, that is entirely an engineering question. The kind of foundation and type of road surface should be decided upon only after thorough investigation, in an engineering way, into all the conditions that have a bearing on the efficiency and service of the road. To be sure, the method of making this selection is sometimes complicated, but nevertheless it can be done succssfully.

Are highway commissioners and highway engineers planning and organizing for construction and maintenance so that the business of road improvement will be carried out efficiently? In some cases I would say yes, but in the majority of cases, no. Too many communities are permitting this to be done for them by over-enthusiastic individuals, petty politicians, and special interests. We find highway commissioners and highway engineers sitting idly by, watching the workings of these special interests, and mistaken ideas taking root in the minds of the public, without a word of protest or a suggestion to offer. The movement at first may be only a ripple on the surface; after a time, like a ripple, it becomes a wave. Still no attention is given it by highway commissioners and highway engineers. Finally, the public becomes convinced (not by sound argument, but by the volume of noise), that their highway commissioners and highway engineers are not doing as they should, and that they do not know their business. The public then turns for advice to the noisy individuals, politicians, and representatives of special interests. Like sheep, the public has become so confused by the noise that it follows the lead sheep, who no doubt it owned by special interests, to the slaughter house and there takes its chances on what it gets.

Highway commissioners and highway engineers often find themselves in a strange position. In order to do their duty and still serve the public in the improvement of roads, it is necessary that they bow their heads and submit to the will of politicians and special interests and do the best they can under the circumstances. Many road and pavement improvements have been planned in this way in many cities and states all over this large country of ours.

Are you highway commissioners and highway engineers having anything to say about the money that is being raised each year in your communities for road improvement? The financing of road improvement operations is a very important phase of the road builder's work. You cannot build and maintain roads without money. It is also true that money will not build and maintain roads. It is just as essential that the proper balance be kept between money for the cost of improvement, and the ability to make the improvement, within reasonable cost, as it is to maintain roads after they are constructed.

In this state road improvements are financed by county prison labor, taxes on automobiles, taxes against adjacent property, federal aid, direct taxation, and bond issues, or a combination of a part or all of these methods. Time will not permit me to discuss all of these methods of financing road improvements. It will suffice, for the purpose of this paper, if I touch on at least one—one that bids fair to be the most wasteful and lead to serious conditions and high taxes—the one known as "bond issues."

All of the foregoing methods of raising money for road improvement are at present fairly well guarded by the laws of the state and national government, except the tax on adjacent property (where roads are built under the so-called Covert Act), and bond issues. As a matter of fact, the tax on adjacent property under the Covert Act has, in principle, worked out as a bonding proposition. Hence, in some respects, the financing of roads and pavements is very similar to raising money by bonding.

If roads are to be built with money raised by bond issues, it is very important that careful preliminary investigations and plans for construction be made before designing the bond issue. If this is not done, the chances are the proceeds from the sale of bonds will be very uneconomically spent, if not largely wasted. To be permanently successful, bond issues must adhere to the principles of sound finance and the money derived therefrom must be expended under skilled engineering supervision only. The errors made in bond issues are many, because bond issues themselves are very little understood by the general public. For this reason, bond issues afford a splendid opportunity for promoting the welfare of politicians and special interests.

In place of attempting an explanation and a discussion of the errors that might be made, I wish to bring to your attention two bond issues that will be voted on at the spring election in April. One of these bond issues will be voted on in Branch County; the other in Jackson County. The resolution passed to submit the question of bonding to the voters in Branch County was as follows:

"Supervisor Wemple read the following report of the special committee appointed to investigate the bonding proposition:"

To the Honorable Board of Supervisors:

Your committee on the question of bonding the county to complete the county road system would respectfully submit the following:

WHEREAS, It is the judgment of the Board of Supervisors of Branch County that it is necessary and desirable to issue the bonds of the County of Branch in the sum of six hundred thousand dollars for the building and construction of improved highways in said county, therefore,

BE IT RESOLVED: that the said County of Branch should contract indebtedness and issue the bonds of said county in the amount of six hundred thousand dollars to raise said sum of money for the building and construction of improved highways in said county to complete the county road system as laid out and adopted by the County Road Commissioners and approved by the Board of Supervisors and State Highway Department;

That said bonds shall be of the denomination of one hundred dollars or of multiples thereof not exceeding one thousand dollars, to be dated June 1st, 1917, to bear interest at the rate of 4½ per cent. per annum, the interest up to March 1, 1918, to be payable on that date and interest to be payable semi-annually thereafter; said bonds to be due and payable in amounts as follows:

$23,000	March 1, 1918
23,000	March 1, 1919
25,000	March 1, 1920
25,000	March 1, 1921
25,000	March 1, 1922
25,000	March 1, 1923
30,000	March 1, 1924
30,000	March 1, 1925
30,000	March 1, 1926
30,000	March 1, 1927
30,000	March 1, 1928
30,000	March 1, 1929
33,750	March 1, 1930
33,750	March 1, 1931
33,750	March 1, 1932
33,750	March 1, 1933
33,750	March 1, 1934
33,750	March 1, 1935
33,750	March 1, 1936
33,750	March 1, 1937

And that said bonds shall contain such other terms, be in such form and be executed in such manner as this board shall prescribe; and,

BE IT FURTHER RESOLVED: that the proposition of contracting indebtedness and issuing the bonds of said countv in accordance with this resolution be submitted to a vote of the electors and duly qualified voters of said County of Branch at the general electon to be held in said county on Monday, the second day of April, 1917, under the provisions of the general elections and statutes of the State of Michigan governing submission thereof to said electors: and,

BE IT FURTHER RESOLVED: that the Board of County Road Commissioners shall present their plans showing what roads will be constructed first and what materials shall be used in construction of the several roads at the April meeting of the Board of Supervisors for their approval.

A study of this resolution discloses these facts:

To begin with, it is proposed to bond Branch County for $600,000, while the arrangement for paying off the bond provides for paying only $596,000. The life of the bond is certainly too long, considering the use to which the money is going to be put. The sum of $126,000 could have been saved by reducing the life of this bond to twelve years. The type of bond is an expensive type. In fact, the same amount of money could have been raised for the same length of time and over $19,000 saved to the taxpayers of Branch County by arranging the manner of payment a little differently. The total cost of this bond will be approximately $895,000. This means that for every dollar expended in the cost of construction of roads, under this bond issue, it will cost the people approximately $1.50.

Then, too, you will notice that under the terms of this resolution the matter of deciding the type and kind of roads, and even the construction itself, is retained in the Board of Supervisors. This is not where it belongs. In fact, it is taking out of the hands of the men elected for the construction and maintenance of roads the very duty they are supposed to perform. It is evident to me from the letters I have had from the chairman of the Board of County Road Commissioners and the newspaper comments I have seen, that the Board of Supervisors of Branch County has been misinformed.

In fact, I am told that it is the intent to build 28 mi. of concrete road and complete the balance of the county road system of building gravel and Class C roads, to the extent of 142 mi. A complete understanding of the cost of building the roods that this bond issue is supposed to build will show at a glance the impossibility contemplated.

Let us look at the conditions in Branch County. There is not a mile of road in the county that has enough traffic over it to justify an expenditure large enough to build a concrete road, or any other type of road costing as much. Then, too, Branch County can raise, under the present law of the state, a little over $84,000 per year for road construction and maintenance. That being the case, if this money were expended toward the completion of a well laid out plan of road improvement, it would not be many years before this county would have a very satisfactory completed road system. Maintenance could also be taken care of out of this $84,000 raised each year. I contend that no county having traffic conditions similar to those in Branch County and that can raise as much as $50,000 per year for road improvement purposes has any excuse for bonding. They certainly haven't when you take into consideration the difficulty we have had in the last few years in contracting even $50,000 worth of work per year. Too much money begets extravagance.

Let us glance for a moment at a resolution passed by the Board of Supervisors, submitting the question of bonding Jackson County for the construction of concrete roads across the county east and west and north and south. As far as I am able to determine, this bond issue contemplates the construction of 52 mi. of concrete road. The resolution is as follows:

RESOLVED: That the question of bonding the County of Jackson for the sum of $900,000 for the purpose of building a concrete road on the trunk line roads, east and west and north and south across the county, be submitted to the electors of the county at the election to be held on the first Monday in April, 1917, said bonds to be issued as needed for payment for work as completed, payable $45,000 each year and bearing interest at 4½ per cent.; and,

BE IT FURTHER RESOLVED: That a special committee of three of this board, together with the county clerk, be directed to follow such legal requirements as necessary for such submission.

This is a better bond issue than the one contemplated in Branch County. It is a serial bond with a life of 20 years. It is a low cost bond, but the principal objection is that it has too long a life. By a reduction in life equal to the life of the improvement contemplated (12 years) a saving of $162,000 can be made to the taxpayers of Jackson County. The total cost of this bond, until it is retired, will be $1,325,250. In other words, the people will pay out $425,250 in interest. This means that every dollar spent in construction will cost the people about $1.50 in round numbers.

The principal objection to this bond is the fact that it specifies concrete roads. I think you will agree with me that no road system can be economically constructed and maintained over a large area of the state, like that in Jackson County, using only one type of construction.

I wish you highway commissioners and highway engineers would stop a moment for reflection and see where we are drifting in the construction and maintenance of roads in this state. Is the best interest of the state being promoted by this method of road building? Should highway commissioners and highway engineers be forced into a plan of road improvement designed, laid out, and even a type of road surface specified by a novice or by special interests? Are you going to spend your period in office trying to smooth out the ruts and rough places in a highway improvement plan—ruts and rough places made often by individuals who have no interest in the road building of the state, except for the money they can get out of it—and putting forth your best efforts in an attempt to secure an economical expenditure? Is it economical to consume your efforts in this way?

It is because of these tendencies toward unsoundness of policy in the construction and maintenance of roads that I appeal to you to make your duty as public officers to collect data and facts pertaining to this work, and distribute these facts to your employer—the public. Study your problems diligently and lay out your plans for work in advance of the actual undertaking. Take a definite stand against any policy that is not for the good of the public. Always strive for efficiency and a perfection of service; and last, but not least, when the way is clear to you pursue it unhesitatingly and persistently. To be a highway commissioner or a highway engineer worth while, you must be a man with a backbone, and a leader in this work.

South Carolina Highway Commission

J. Monroe Johnson, of Marion, S. C., was recently elected chairman of the South Carolina State Highway Commission at a meeting held for the purpose of organizing the new commission.

The other members are: Prof. M. Goode Homes, University of South Carolina; Maj. Robert G. Thomas, Charleston; Prof. Haile Houston, Clemson College; C. O. Hearon, Spartanburg.

Bids Asked on Illinois Road Work

The State Highway Commission of Illinois will receive at Springfield until 11 a. m., March 28, sealed proposals on the following state aid road work:

BIDS FOR ILLINOIS ROAD WORK.

County	Section	Type	Nearest post office	Approximate length, feet	Estimated cost exclusive of cement furnished by state
Bureau	E	Concrete	Manlius	3,700	$9.333.80
"	F	"	Tiskilwa	4,094	8,696.60
"	G	"	Ohio	4,300	8.663.32
"	I	"	Ladd	4,550	8,614.40
"	J	"	Neponset	4,420	9,526.68
"	K	"	Princeton	4,200	7,832.72
Cass	F	Brick	Virginia	1,540	4,175.00
"	G	Bituminous macadam	Beardstown	3,600	6,715.00*
"	H	Concrete	Chandlerville	1,000	1,154.00
Ford	C	"	Elliot	4,300	9,341.00
Champaign	E	Brick	Urbana	4,950	12,664.64
"	G	"	"	4,950	12,982.42
"	J	"	Champaign	4,950	12,477.62
Hancock	E	Earth	Dallas City	7,000	4,674.00*
"	F	"	Tennessee	10,300	3.706.00
"	G	"	Augusta	13,478.7	4,486.00*
"	H	"	Elvaston	10,206	3,986.00
Jo Daviess	E	Concrete	Galena	2,475	4,430.00
"	F	"	Elizabeth	2,290	4,261.00
McHenry	I	Gravel	Woodstock	10,500	12,920.00
"	J	"	"	11 500	13,138.00*
McLean	A	Earth	Shirley	67,286	31,663.00
"	B	"	Bloomington	14,500	4,968.00*
"	C	"	"	113,000	53,717.00
Marion	E	"	Sandoval	13,239	5,728.00
"	F	"	Salem	3,600	5,245.00
Menard	D	Concrete	Petersburg	2,400	4.828.00
Monroe	B	"	Columbia	3,190	4,010.60
Moultrie	C	"	Sullivan	4,700	8,724.00
"	D	"	"	5,280	7,624.00
St. Clair	E	W. B. Macadam Resurfacing	E. St. Louis	18,446	20,574.00*
Washington	B	Earth	Nashville	22,750	7,814.52
Winnebago	D	W. B. Macadam	Rockford	900	2.638.00*
"	E	Concrete	"	9,485.7	23,260.00
DuPage	D	Concrete and W. B. Macadam	S. Elmhurst	4,300	18,781.00

*No cement will be furnished by the state.

Plans for the above work may be examined at the offices of the county clerk and the county superintendent of highways of the counties in which it is located, at the office of the division engineer of the State Highway Department in whose district the work is located, or at the office of the commission at Springfield.

State Highway Commission for Texas

The legislature of Texas has passed a bill creating a state highway commission. Under its provisions there will be three members of the commission and a state highway engineer. The bill levies a horse-power tax upon all motor vehicles and it is expected that under this provision an average annual revenue of about $9 will be obtained from each automobile and other motor vehicle.

According to the latest available statistics there were in Texas on January 1, 1917, approximately 200,000 automobiles and other motor vehicles, and they are increasing in number at the rate of about 7,000 per month. By the time the bill becomes operative, July 1, it is expected that the annual revenue to be obtained from this tax will considerably exceed $2,000,000, all of which is to be applied to the construction of good roads.

It is the tentative plan of the prospective new commission to first build a system of cardinal roads traversing the state. Leading out of these there will be constructed lateral highways and the work will be thus carried on until the state is provided with a complete system of public roads.

Missouri Highway Commission Appointed

The new State Highway Commission of Missouri, recently created by the passage of the Hawes road bill, has been appointed by Governor Gardner of that state as follows:

C. O. Raine, of Canton; E. L. Sanford, of Springfield; A. C. McKibben, of Clayton; George E. McIninch, of St. Joseph. They are to receive a salary of $1,000 a year each, and are authorized to employ a chief engineer at a salary of $5,000 a year, and two assistant engineers at $2,500 a year.

Trunk Line Highway System for Winnebago County, Wisconsin

A resolution providing for a trunk line system of highways was adopted recently by the Board of Supervisors of Winnebago County, Wisconsin, by a vote of 36 to 4. The system comprises five trunk lines, as follows:

No. 1, Fond du Lac-Oshkosh, Neenah-Appleton and Dale Roads, 26½ mi.; No. 2, Oshkosh-Omro-Poysippi-Omro-Eureka Road and the Waupun-Oshkoksh-Winneconne-Winchester-Omro Road, 34 mi.; No. 3, Neenah-Menasha-Winchester-Wolf River Road, 22 mi.; No. 4, Oshkosh-Omro-Poysippi-Omro-Eureka Road, 28 mi.; No. 5, Ripon-Berlin Road, 34 mi.

A second resolution passed by the board provides that appropriations for 1918 shall be applied to work on roads in trunk lines Nos. 1 and 2, for 1919 on Nos. 3 and 4, and for 1920 equally on Nos. 5 and 1, and thereafter in the same rotation from year to year, until the system is completed. The county unit plan was also substituted for the town unit plan.

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Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

MARCH 24, 1917.

THE DUTY OF HIGHWAY ENGINEERS AND OFFICIALS TO THE PUBLIC

Much food for serious thought is contained in an address—printed on other pages of this issue—made in the short course in highway engineering at the University of Michigan last month by John J. Cox, Assistant Professor of Civil Engineering at the university.

Certain duties are prescribed by the laws creating the various positions held by road and street officials and engineers. These legal duties carry with them—or, perhaps, are embraced in—what Prof. Cox terms a "moral" or a "business" duty not explicity laid down by statute. Under a form of government in which the powers of those who govern are delegated by the governed, the official is the agent of the people and the people's employee. As such he is responsible to his employers for results and obligated to put their interests first—so long as he remains an employee—to just the same degree as is the employee of a private individual or corporation. Sometimes public officials disregard this and arrogate to themselves powers that they do not possess, seemingly forgetting that they are answerable to the public.

Disregarding for the moment the small percentage of dishonest administrators, consider the great majority who are trying to the best of their ability to discharge faithfully and efficiently the duties of their positions. The very nature of the positions they hold often brings up perplexing problems. For instance, the highway engineer is, or should be, a public servant chosen to carry out some particular branch of the public's work because he is especially qualified by training or experience, or both. His knowledge of the work intrusted to him is expert, greater than the knowledge of his employers. In other words, in a given case such as the selection of the type of pavement to lay on a certain street, he knows how to proceed better than his employers do. It is very likely, however, that in an instance of this kind his employers—the public—will have a very decided preference for some particular kind of pavement, one that the engineer knows is unsuitable. It may be that the people have made their choice because of representation by some of the "special interests" to which Prof. Cox refers. What course should the engineer pursue? Should he state his position clearly and defer to public clamor or should he—if he has the power—decide in accordance with his own judgment, at the same time giving his reasons? The public employee in such circumstances is confronted with the same problem that the employee of a private organization often faces. He must decide how far he is justified in jeopardizing his own material welfare by arguing against his employer or his immediate superior to secure a decision that he honestly believes will inure to the benefit of his employer. The matter can be reduced to the homely question: How far should he "quarrel with his bread and butter?"

Another phase of the duty and responsibility of the engineer is brought out by Prof. Cox's allusion to the activities of "special interests." The individuals and organizations interested in the sale of materials and machinery used in road and street work naturally try to sell their wares where such work is to be done. Some of these interests undoubtedly urge the use of their materials where others would be more suitable, but we believe that conditions have improved and that they are not as unfortunate as Prof. Cox intimates. The enormous amount of road and street work done every year and the inevitable increase in the future make room for all materials. And most promoters realize that satisfactory pavements are the best recommendations for their materials and that good results cannot be secured by the use of their materials where something else should have been employed.

Another point brought out by Prof. Cox, the wasteful financial methods sometimes employed, should be given the most careful study. No one knows the amount of the annual loss from this source, but it is without doubt very considerable. There is no lack of reliable information on different bond issue plans nor any doubt as to the undesirability of paying for short-lived improvements with the proceeds of long-term bonds. Yet the practice continues, perhaps partly a result of the efforts to promote various kinds of pavements.

The last matter referred to in the address is the passing of bond issue resolutions specifying the construction of a pavement of any particular type on a town, county or state road system. There might possibly be a county road system for which one type of roadway would meet all requirements, but such a condition would be very unusual.

Five Bridges to Span the Snake River in Idaho, in a territory reaching from the Oregon line to Bruneau Bridge, in the southwestern part of the state, a distance of 125 mi., are to be constructed at a total cost of $150,000, of which the state will pay $50,000, the counties which the bridges will connect paying the balance. At present there are no bridges across the river between the points named, the use of ferries being necessary for crossing. It is stated that the structures will be of steel, 400 to 800 ft. in length.

The Best Time to Regrade or Reshape Roads of Earth or Gravel is early in the spring before the road entirely dries out and before the dry weather begins, according to County Engineer White, of Pierce County, Washington. Satisfactory results may be obtained at other times, he says, if the ground is not too dry or too wet. The split-log drag for maintaining earth roads has been abandoned by Pierce County for a steel drag which digs deeper into the ground. The blades can be set at any angle and the amount of material to be dragged can be controlled. The Pierce County equipment consists of a steam shovel with six Western dump cars and about 1,000 ft. of 20-lb. rail. This is used in the construction of new roads on sidehill work. Under favorable conditions, dirt has been moved in this way for about 7 ct. per cu. yd. Above 1,200 ft., it has been found advisable to transport dirt by wagons. These roads are built from 12 to 24 ft. in width, with a crown of 1 in. per ft. in width, according to Mr. White. Deep drainage ditches are dangerous for traffic, so wide shallow ditches are being made. Corrugated metal culverts are used in the remote districts, but in all paving contracts concrete pipe is laid.

The State Highway System of Idaho and the Past Year's Work[*]

By **E. M. BOOTH**[†]

I take pleasure in giving the following brief discussion on road work in Idaho, as applied particularly to state highways.

During the past two years the State Highway Department has expended approximately $825,000 on road construction. Practically two-thirds of this amount has been contributed by the counties in which the work was done; the balance has been paid by the state.

Prior to 1915, or during a period of approximately 25 years, the legislature had, from time to time, made appropriations for road and bridge construction in various parts of the state to a total of $575,000. Adding to this amount the $200,000 bond issue authorized in 1913, and about $140,000 of revenue from the motor vehicle tax, we arrive at a grand total of $915,000 appropriated by the state for roads and bridges to date. Most of these appropriations were subject to like amounts being raised by the various counties in which the work was to be done.

The available information on county expenditures for general road purposes is not accurate, but the U. S. Office of Public Roads and Rural Engineering reports that approximately $1,000,000 was expended by the counties of this state in 1915, and probably about the same sum in 1916. I believe it a conservative estimate to say that at least $12,000,000 has been spent by the counties on road work during the past 25 years. Due to necessity and topographic conditions, much of this money was spent on temporary construction, as it was a case of opening up new territory for settlement within a short period. Valuations were low, money scarce, and road projects many, with the result that nearly all of these original roads have been abandoned and new ones built with lower grades and better roadbeds.

Until three years ago, but little was done toward the laying out of a comprehensive system of highways for the state. During 1914 surveys were made by the State Highway Department for a system of roads to connect the centers of population, constituting main trunk lines to aid in developing the dormant resources of the state. In 1915 and 1916 the state and counties expended over $800,000 on cooperative state highway construction. The roads so built are in general a great improvement over the old county roads, but due to a lack of finances they are not up to as high a standard as state highways should be, many of them being nothing but streaks of dust in the summer and lanes of mud in the winter, because little surfacing has been done and as traffic has been heavy the roads were doomed to be cut to pieces.

As a rule the cooperation of the county commissioners with the Highway Department has been hearty, and has made possible such success as has been attained. Many counties have advanced funds for the state's share of the cost so that construction work could be continued. The worst feature has been that much damage to the roads has resulted from the lack of maintenance funds. We trust that a kind Providence and a liberal-minded legislature will see fit to provide the State Highway Department with sufficient funds to insure keeping faith with the counties and to complete a comprehensive highway system, not overlooking the money necessary for the proper maintenance of the highways when completed.

The highway system of the state, as now laid out, includes three main north and south routes and two east and west routes, with certain branch lines and connecting links.

The two arteries of the system extending east and west are known as the Idaho Pacific Highway and the North Pacific Highway. The Idaho Pacific Highway traverses the southern part of the state from Bear Lake County to Washington County, passing through Paris, Pocatello, American Falls, Burley, Twin Falls, Hagerman, Glenns Ferry, Mountain Home, Boise, Nampa, Caldwell and Weiser. The North Pacific, known locally as the "Yellowstone Trail," crosses the Panhandle in Kootenai and Shoshone Counties, passing through Coeur d'Alene and Wallace.

The north and south routes are located respectively in the eastern, the central and the western sections of the state. In the eastern part of the state is the Yellowstone Park route, which extends northerly from Franklin County to Fremont County through the towns of Preston, Pocatello, Blackfoot, Rigby, Rexburg and St. Anthony to the state line near Yellowstone Park. In the central section of the state, the Sawtooth Park route extends northerly from Twin Falls through Jerome, Shoshone, Hailey, Stanley, Challis and Salmon City to the Montana line. In the western part of the state is the much talked of North and South Highway, extending northerly from Weiser through Cambridge, Council, Grangeville and Lewiston to Moscow.

The construction of these main arteries will cost an immense sum of money, and therefore if the state highway work is to be intelligently carried on, it will be necessary to devote attention to these trunk lines for a few years, to the exclusion of the branch lines and connecting links.

It may interest you to know how the money which has been used has been distributed in regard to class of construction. An average of all the work shows that of each dollar expended, 56 ct. was for grading, 26 ct. for bridges, 2 ct. for right of way, 7 ct. for surfacing, and 9 ct. for engineering and supervision.

Topographic and soil conditons vary to such an extent in different sections of the state that I cannot give close figures on the average cost per mile of standard roadbed. In some parts of the southern section of the state the cost has run as low as $500 per mi., while some work recently done in northern Idaho averaged $10,000 per mi., and for a short distance reached a cost of $20,000.

To get the proper efficiency out of the graded roads, they should be surfaced with either sand-clay or gravel, but the department is facing the problem of how to construct some 1,600 mi. of highways with very limited funds. If one were to judge from local reports, each one of the 1,600 mi. of the system is the most important mile in the state. I think that probably the remark which I hear more than any other as I travel over the state is: "Booth, there is no question about it, we have the most important road in the state, and the Highway Commission should be very liberal with us."

As a matter of fact, every road laid out by the department is a very important one and should receive liberal support, but liberal support means the appropriating by the state of a great deal of money, and unless the legislature now in session sees fit to give the State Highway Department the financial support it requires, it will be necessary to postpone the construction of certain sections of these highways until some future time.

The following general information may interest you as having a bearing upon the road situation: The estimated total mleage of all roads in Idaho is 25,000, and the average population per mile of road is 16. The assessed valuation of the state is approximately $400,000,000, or about $16,000 per mi. of road. The area of the state is 83,354 sq. mi., of which practically one-third is in forest reserves, one-third in state and government lands, leaving but one-third which is taxable for road work.

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[*] Paper presented at the 1917 convention of the Idaho Society of Engineers.

[†] State Highway Engineer of Idaho.

In my estimation, the problem of road work in Idaho is of greater importance to the people of the state than any other problem which we are now facing. As shown above, only one-third of the area of the state is taxable, and therefore of real value at the present time, the rest of the vast resources of Idaho lying dormant, due principally to lack of transportation facilities.

If Idaho is to open her enormous mineral and forest wealth to the investor, or her wonderful scenic attractions to the tourist, it is necessary that permanent highways be built in the near future.

West Virginia Embodies Road Laws in Special Act

An act to amend, re-enact, codify and embrace in one act all the general laws of the State of West Virginia "on the subject of public roads, ways and bridges; to provide a complete system of laws governing the construction and maintenance of public roads and ways and the regulation of traffic thereon; to classify such roads and provide for a connecting system of highways throughout the state; to provide methods of raising revenues for the construction and maintenance of such roads; to provide for the cooperation of the state and federal government in raising and expending such revenues; to create a state road commission and prescribe the duties and define the powers of such commission and of all state and local officers engaged in the administration of the road laws of the state" was passed recently by the legislature of West Virginia.

The act contains 183 sections, grouped under divisional headings as suggested above.

Section 2 provides that authority and control over the construction, maintenance and regulation of all public roads within the state shall be vested in the State Road Commission and in the several county courts, respectively, under the regulations prescribed, such county courts having the superintendence and administration of the establishment and regulation of all public roads, ways and bridges within their respective counties, with authority to lay and disburse the county and district levies applicable thereto.

Section 3 provides that the public roads of the state shall be classified as Class A and Class B, the former including all main county roads receiving federal or state aid, and the latter including all other roads which shall be known and designated as district roads, such classification not to apply, however, to the streets and alleys of incorporated cities and towns.

Section 5 of the act assents to the provisions of the federal aid road act, approved July 11, 1916, and authorizes the State Road Commission to enter into all contracts and agreements with the United States Government relating to the survey, construction and maintenance of roads under the said act, and to do all other things necessary fully to carry out the cooperation so contemplated and provided.

Section 6, specifying the powers and duties of the State Road Commission, which shall consist of two members, provides that before the first day of June, 1917, the governor of the state shall appoint two commissioners, who shall be residents and citizens of the state, one each from the political parties casting the highest number of votes for governor at the last general election,

> one of whom shall be a practical civil engineer of known business qualifications and who shall have had at least three years' responsible charge of the construction and maintenance of public roads and highways. The other member shall be of known and successful business qualifications and one shall be designated by the governor as secretary-treasurer of said commission. Said commissioners shall immediately enter upon their duties and hold office for two and four years, respectively, from the first day of June, 1917, the term of each to be designated by the governor, but their successors shall be appointed for the term of four years, excepting that any person appointed to fill a vacancy shall serve only for the unexpired term, but any commissioner shall be eligible for reappointment. Any commissioner appointed to succeed another whose term has expired, or to fill a vacancy, shall be appointed from one of the two political parties casting the highest number of votes for governor at the last preceding general election, but, provided, always, that not more than one of the commissioners serving at any one time shall have been appointed from the same political party. * * * The secretary-treasurer of said commission shall execute a bond with security to be approved by the governor, in the penalty of not less than $50,000. * * * No person while in the employ of, or holding any official relation to, any person, firm or corporation selling or furnishing any materials entering into the construction or maintenance of any of the roads or highways of this state, or any part thereof, or who is pecuniarily interested therein, shall enter upon the duties of, or hold said office. Nor shall any of said commissioners be a candidate for, or hold any other public office, or be a member of any political committee while acting as such commissioner.

Section 7 authorizes the commission to select such assistants, agents and employees as may be necessary, and requires each commissioner to devote his entire time to the performance of the duties of his office, at a salary of $3,500 per annum and the actual expenses incurred in the discharge of such duties.

Section 8 of the act requires the secretary-treasurer to keep a record of all proceedings of the commission, to issue notices, to keep all books, maps, documents and papers ordered filed by the commission, and all orders, rules and regulations made or approved by the commission. He shall issue all licenses, registration certificates, receipts and other official documents provided for by the act, and shall receive all moneys collected by the commissions from license or other fees, and all moneys and funds coming into the hands of the commission from any source, making a weekly report of such receipts to the auditor of state and pay to such auditor the amount collected.

Under sections 9 and 10 the State Road Commission has power to establish and amend rules and regulations not inconsistent with the law, concerning the duties of county road engineers in relation to Class A roads and concerning all public roads under the supervision of the commission; and to supervise and furnish information as to location, construction and maintenance of all Class A roads in the state; to provide for giving instruction in road building, and to supervise the construction of the main county roads.

Section 11 requires the commission to compile statistics and gather information relating to road building, improvement and maintenance and to disseminate such information throughout the state by means of farmers' institutes or other meetings, and such bulletins as may be issued by the colleges of agriculture and engineering or from other sources, such public meetings to be held in each county under the general supervision and control of the commission for the purposes named above.

Section 12 requires that all materials used upon the main county roads receiving federal or state aid shall first be carefully analyzed by the commission, and may not be used until approved in writing by the commission. The county courts may arrange with the commission for the analysis of other materials for any other roads in Class B.

Sections 16, 18 and 19 provide for the cooperation of the commissioners of agriculture, the dean of the college of engineering, the director of the experiment station and the heads of the several departments of science of the State University, with the State Road Commission; that the commission shall make an annual report to the governor of its conduct and work, and that the attorney general of the state shall be the legal adviser and representative of the commission and shall prepare for it all contracts, forms and other documents whenever required.

Section 20 relates to Class A, or federal aid and state aid roads, and requires that such main county roads shall be so located as to lead to the county seat of an adjoining or adjacent county, or to an important commercial center thereof, or of an adjoining state, so that each of such roads will connect at the border of said county with a like road established or designated by the county court of another county, or connect at such border with a road of an adjoining state, and so far as practicable pass through or near important towns. When practical, no such main county road shall have a grade exceeding 5%, and in no case shall a steeper grade exceed 9%, and then only for as short a distance as practicable, and the right of way for such roads shall not be less than 40 ft. in width with necessary slopes for cuts and fills. All such roads shall have drainage structures of permanent construction.

For the establishment of such main county roads the commission shall prepare a map of the state suggesting a state-wide system of inter-county roads and send a copy to the county court of each county, which shall within not to exceed 90 days thereafter designate two or more main thoroughfares or routes extending to the borders of the county as a part of the system, and if the commission finds that the roads meet with the provisions of the act, it shall approve two of the roads so designated. The county court shall then order said roads or routes to be surveyed and located under the direction of the commission. Failure or refusal on the part of a county court to establish roads designated and approved shall disqualify the county from participation in federal or state aid funds.

In the location and establishment of main county roads, the county courts shall have power to exercise the right of eminent domain for condemnation of rights of way in accordance with the law governing road location, except that the location of an established road shall not be changed without the written consent of the state road commission.

Any street, or portion of street, in any incorporated city, town or village may be designated by the county court, under Section 20, as a connecting part of main county road or a district road, and the county may put the same in good condition, but its proper maintenance must be paid for by the municipality. A similar provision is made where a municipality is unable financially to construct and maintain bridges on a main road within corporate limits.

Under Section 22 the county court shall lay a county road levy (in addition to the general county and district levy) not to exceed 25 ct. on each $100 assessed valuation of all taxable property in the county, the proceeds of which shall be known as the "county road fund," to be expended only for the construction, improvement and maintenance of the "main county roads" and bridges thereon. If in any one year this levy produces a revenue in excess of the amount necessary for main county roads, the excess may be applied to construction or repair of important district roads, or roads in Class B.

Section 23 provides that the court may permanently improve the main county or district roads within the county and contract therefor with any contractor for the use of any of the foregoing systems, and take bonds and security in a penalty equal to 50% of the estimated cost of the work in question.

It further provides that the State Road Commission shall prepare general plans and specifications for the construction and repair of the main county roads by means of the various kinds of materials, including therein the grading and improvement of dirt or earth roads, and transmit copies thereof to the several county courts of the state for their information.

Section 24 creates a "state road fund" which shall consist of the net proceeds of all state license taxes imposed upon motor or steam-driven vehicles, and the registration fees imposed upon chauffeurs on and after Jan. 1, 1917, all donations to such fund, or appropriations to it by legislature or by congress, or from any other source. The state road fund shall be used for paying the expenses of the State Road Commission, and the balance shall be distributed among the counties annually on a mileage basis.

Section 26, relating to the issuance of bonds, provides, subject to certain limitations contained in the state constitution, that when in the opinion of the county court the levies made by law together with appropriations by the state or federal government are insufficient to construct any main county or district road or bridges thereon, and upon the filing of a petition praying for such construction, signed by 25% of the legal voters within any district, the court shall instruct the county road engineer, or other competent engineer, to investigate the proposed improvement, and his report including an estimate of the cost of the work shall be submitted to the State Road Commission, and if approved by it, the proposition shall be submitted to the legal voters of the county, or district, either at a general or special election.

Section 31 provides that in addition to the general county and district levy, the county court shall lay a district levy not to exceed 15 ct. on each $100 assessed valuation of all taxable property in each of the several districts of said county, the proceeds of which shall be known as the "district road fund" and shall be expended only for the construction, improvement and maintenance of district roads or parts thereof and bridges thereon.

Under Section 33 the county court shall levy for road purposes a capitation tax of $1 on each male inhabitant of the county who has attained the age of 21 years and not liable to labor on the roads or pay the commutation elsewhere provided for.

Section 34 of the act creates in the several counties the office of county road engineer, who is to be appointed by the county court, and who shall be a practical road builder. In case a county road engineer is not appointed as provided, then the court may appoint a competent road supervisor.

The county road engineer shall hold office for the term of two years from and after Jan. 1 following his appointment; his compensation fixed by order of the county court shall not be less than $900 nor more than $3,500 per year.

Section 48 creates the office of district road patrolman who shall be appointed by the county court between the first day of March and the first day of April of each year, and shall be an able-bodied man between the age of 21 and 50 years and a resident of the district or county.

In relation to the location, establishment and discontinuance of highways, section 68 provides that no bridge, unless it is for foot traffic exclusively, shall be less than 14 ft. wide, and that all established public roads shall occupy a right of way not less than 30 ft. wide, unless a special order is made for a different width, and that roads to be established shall be not less than 30 ft. wide, and the necessary slopes.

Sections 87 to 91, inclusive, regulate the calling of bids and the awarding of contracts, and require that any person, firm or corporation offering for sale or selling any paints, metal or metal culverts, or other material or supplies for use in the construction of roads and bridges shall furnish a certificate of its purity showing its chemical constituents and the percentage of impurities contained therein.

Prison labor on permanent road work is provided for in sections 92 to 116, inclusive, when the proposed improvement has received the approval of the State Road Commission.

Section 118 regulates the operation of motor vehicles on public roads and streets, but does not prohibit any city, village or town from prescribing regulations relative to the speed of such vehicles.

Section 119 provides that "no person shall drive or operate any vehicle, motor-driven or otherwise, upon any public road or street of this state, when intoxicated or under the influence of liquor, drugs or narcotics"; and provides that any such person upon conviction shall be fined not less than $5 nor more than $50, or imprisoned not less than 10 nor more than 60 days.

No vehicle in excess of 90 in. in width shall be operated, under section 26 of the act, upon the highways of the state unless authorized by special permit, and then only upon highways of extra width; nor shall any vehicle, including load, exceeding 30,000 lbs. in weight, or on which the weight of the load is more than 600 lbs. per in. width of tire, the total width of the four tires being included in computing the weight thereof, be operated unless by special permit, and only upon highways specially constructed for heavy traffic.

Other sections relating to the operation of motor vehicles provide that no person under the age of 14 years shall operate such a vehicle upon the highways of the state unless accompanied by the owner or a duly licensed chauffeur; that every person desiring to operate a motor vehicle as a chauffeur or for carrying on the business of transporting passengers or freight for hire, shall file an application to that effect with the State Road Commission and pay a license fee of $3; that a certificate of registration is required for each motor vehicle driven upon the roads of the state, and that the annual registration fee shall be $10 for vehicles (excepting motorcycles) weighing 2,000 lbs. or less, and an additional 25 ct. for each 100 lbs. of weight in excess of 2,000 lbs.

Under section 139 of the act the State Highway Commission shall have full power to make and enforce rules and regulations for the protection of all streets and roads from unnecessary damage by the operation of motor vehicles, "and shall levy and collect such privilege tax on each permit granted, as will lay upon the owners or operators of each class of such vehicles an equitable share of the burden of cost for the upkeep and maintenance of such streets and roads." The commission "shall classify such vehicles and fix the amount of the privilege tax to be paid for a permit on each class and shall prescribe rules and methods for the computation of such tax."

Section 141 provides that "all moneys collected from the licensing of such vehicles and credited under said rules to their operation over state aid, federal aid, and inter-county roads, including 10% of all moneys collected for the use of main county and district roads, and streets and roads within incorporated towns and cities, shall be paid into a general state road fund, to be used as the State Road Commission may direct in the maintenance and repair of state aid, federal aid, and inter-county roads."

Section 142 provides that the privilege tax shall be levied in addition to the prescribed regular state tax on motor vehicles, and no other license fee shall be charged except the regular property tax, with respect to such vehicles and their operation.

Sections 143 to 151, inclusive, relate to toll roads and bridges and provide for their regulation.

Among the general provisions of the act are the following: That the county road engineer may authorize the owners of property adjoining the public roads to plant shade trees; he may authorize the owner or occupant of lands to construct and maintain a watering trough beside the public road to be supplied with fresh water and easily accessible for horses with vehicles; that any person who shall drive or ride over a bridge faster than a walk shall be fined $5; that any person who shall use on any public road not covered with ice a vehicle with a chained wheel, unless the same rests upon an iron shoe at least 6 in. wide, shall be fined not more than $5.

Section 183 repeals "Chapters 43, 43-a, and 43-b., and Sections 44 and 104 of Chapter 32 of the code of 1913, and Chapter 8 of the acts of the legislature of 1915, second extraordinary session, together with all other acts and parts of acts coming within the purview of this act and inconsistent herewith" excepting any "local act or acts heretofore passed relating to roads, streets, alleys, bridges or public landings, and not herein specifically referred to, amended or re-enacted."

Bids Asked for Proposed Improvement in Ohio

Road work in the State of Ohio upon which contracts are to be let by the State Highway Department is shown in the accompanying table. Bids will be received at the office of the department at Columbus until 2 p. m., March 30.

BIDS FOR OHIO ROAD IMPROVEMENT.

County	Sec.	Name of Road	Length of Pavement, Feet	Width of Pavement, Feet	Kind of Road	Estimated Cost
Butler	A	Carthage-Hamilton	31,542	16	Monolithic brick	$119,414.10
"	C	Hamilton-Scipio	9,500	16	Concrete	36,610.22
Hamilton	A	Cincinnati-Hamilton	25,441	20	Brick	$186,839.82-$198,486.78
					Reinforced concrete	$140,365.80
					Bitulithic	183,057.80
					Bituminous concrete	160,436.60
Harrison	J	Bridgport-Cadiz	12,422.5	12	W. B. Macadam	15,854.10
Jefferson	L	Steubenville-Cambridge	20,900	16	(Grading bridges and culverts and repairing roadbed)	41,892.15
Warren	B	Morrow-Lebanon	23,612	10	W. B. Macadam	10,950.00

Street Cleaning Work in Flint, Michigan

The street officials of the City of Flint, Mich., and citizen organizations are considering the matter of street cleaning work in the city. It is reported that a reorganization of the department will be made and that it will be equipped with up-to-date machinery.

There are about 40 mi. of paved streets in the city, most of which are of sheet asphalt in good condition. Cleaning at present is done by hand labor and several flushers.

It is expected that a preliminary report on the proposed reorganization will be made early in April.

The Building of a Concrete Road Between Newport News and Hampton, Va., was advocated at a recent mass meeting in Hampton. It is claimed that the enhancement of land values along the route, to say nothing of public convenience, would more than repay the county for the expense of construction.

MEETINGS

Calendar of Coming Meetings

March 27-30.—Ontario Department of Public Highways—Annual conference of County Road Superintendents and Engineers, Parliament Buildings, Toronto, Ont.

April 10-14—Dominion Good Roads Association—Fourth Canadian and International Good Roads Congress, Horticultural Building, Ottawa, Ont., Can. Secretary, Geo. A. McNamee, 909 New Birks Building, Montreal, P. Q.

April 16-18.—Portland Cement Association—Spring Convention, San Francisco, Cal. Secretary, F. L. Page, 111 West Washington St., Chicago, Ill.

April 17-20.—U. S. Good Roads Association—Fifth annual convention, Birmingham, Ala. Secretary, J. A. Rountree, 1021 Brown Marx Building, Birmingham, Ala.

May 7-9.—National Conference on City Planning—Annual Conference, Kansas City, Mo. Secretary, Flavel Shurtleff, 19 Congress St., Boston, Mass.

June 11.—New York State Conference of Mayors and Other City Officials—Annual Conference, Buffalo, N. Y. Secretary, W. P. Capes, 25 Washington Ave., Albany, N. Y.

June 26-30.—American Society for Testing Materials—Annual meeting, Atlantic City, N. J. Secretary, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

Vermont Society of Engineers

At the fifth annual meeting of the Vermont Society of Engineers held at Burlington, Vt., March 14, officers were elected as follows:

President, Prof. A. E. Winslow, Northfield; Vice Presidents, B. M. Hayward, Montpelier, and C. F. Purinton, Burlington; Secretary-Treasurer, G. A. Reed, Montpelier; Directors, Prof. J. W. Votey, Burlington; F. W. Denison, St. Albans, and E. D. Blackwell, Brandon.

Tri-State Good Roads Association

The fourth annual convention of the Tri-State Good Roads Association will be held at Medford, Oregon, on May 16 and 17. This association was organized in 1913 in the interest of good roads in the states of Washington, Oregon and California, and its work during 1917 will be devoted chiefly to efforts to secure the passage of the $6,000,000 road bond issue which will come before the people on June 4. A program is arranged for the Medford meeting which it is expected will be attended by a large number of practical road builders as well as others interested in road improvement.

Officers of the association are: President, J. A. Westerlund, Medford; Vice President, C. C. Chapman, Portland; Executive Secretary, Geo. E. Boos, Medford; Treasurer, J. Edgar Allen, San Francisco, Cal.

Supervisors' Association of Cambria County, Pennsylvania

A good roads meeting to which the public has been invited will be held by the Cambria County Supervisors' Association at Ebensburg, Pa., March 28 and 29. A general program, including addresses, reports of committees, election of officers, will be followed. Among the subjects to be presented for discussion are:

"A Better Organization of Supervisors of Cambria County," "Is It Prudent for the Supervisors to Let the Maintenance of Sections of Their Roads by Contract?" "How to Make the Best Township Roads with Materials at Hand," "The Need of Cooperation Between Supervisors and Their Constituents," "The Best Way for a Township to Begin Making Permanent Roads." It is understood that officials from other counties in the state will be in attendance and that the meeting will be in the nature of a good roads rally.

PERSONAL NOTES

O. J. De Spain has been appointed City Engineer of Ritzville, Wash. He was recently County Engineer of Adams County.

H. S. Owen, of the City Engineering Department of St. Louis, Mo., has been made Field Engineer of the Portland Cement Association, with office at St. Louis, Mo. His work will be in the eastern part of the state.

G. W. Thompson, formerly Consulting Engineer of the Trussed Concrete Steel Co., has joined with Walter D. Binger under the name of Thompson & Binger, Inc., Engineers and Contractors, with offices in New York City and Syracuse, N. Y.

John F. Alden, a bridge engineer of wide reputation, died recently at his home in Rochester, N. Y. He was an officer of the American Bridge Co. and was connected with the building of a large number of railway and highway bridges in the United States. He was a member of the American Society of Civil Engineers, the Rensselaer Society of Civil Engineers and other engineering societies.

NEWS NOTES

Street Lighting in Bluffton, Ohio, is to be improved with the proceeds of a special bond issue of $35,000, according to a report.

For Building Two Cardinal Roads Across Taylor County, Texas, a road bond issue of $100,000 is being agitated by interested persons.

The Illinois Highway Improvement Association is giving active support to the $60,000,000 bond issue proposal now before the state legislature.

A Road Bond Election in Limestone County, Texas, has been ordered for March 24. The amount of proposed bonds, $100,000, is to be used in Road District No. 9.

Grant District in Marion County, West Virginia, will hold an election on March 27 to vote on a proposed bond issue of $195,000 to be used for road purposes.

The Commissioner's Court of Smith County, Texas, is being petitioned to call an election to vote on issuing $500,000 bonds for the construction of roads in the county.

The Proposition to Bond Chester County, South Carolina, for $450,000 will come before the people at an election on March 27. A vigorous campaign is being waged in its favor.

By a Special Act of the Illinois Legislature, the citizens of Peoria County are permitted to vote on the question of issuing bonds in the amount of $1,700,000 for the improvement of state aid roads. The election will occur on April 3.

The Abutting Property Owners on Cedar St., Sturgeon Bay, Wis., are charged with the cost of constructing a 3-ft. curb and gutter along four blocks of the street between Pine and Garland Sts., to be collected in the next tax levy according to law.

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Large Mileage to be Added this Year to Michigan's Improved Roads

By D. A. THOMAS*

Reports received by the Michigan State Highway Department indicate that at least 1,000 mi. of state rewarded roads will be built by counties under the county road system during 1917. Much of this mileage will be on trunk line roads of state and interstate importance. With the mileage constructed by the townships, it is reasonable to believe that a total of between 1,200 and 1,400 mi. will be reached for the season.

This belief is substantiated by a consideration of the mileage applied for to the department. For several years past the applications on file at any time have been about double the mileage that has actually been completed during the succeeding year. On January 1, 1917, applications were on file for a total of 2,857 mi. of road, on which the reward would amount to a total of $3,666,419, the state's share of the cost of construction.

The average cost of all roads up to date has been approximately $3,500 per mi. On this basis it would take nearly $10,000,000 to build the roads at present applied for. In all probability, however, the roads constructed during the coming year by the counties and townships of Michigan will be completed at a cost of about $5,000,000. It is true that much more than this is available for construction, as many counties have bonded for large sums and bond issues will be submitted to the voters in several counties at the spring election, but of course not all the money derived from the sale of bonds will be spent during 1917.

The expenditures are not confined to any particular section, but are well distributed throughout the whole state, and each locality is attempting to do its share. A commendable feature is the fact that almost without exception the various boards of county road commissioners have determined to spend large sums on roads that "start somewhere and go somewhere." The through highways will come in for a big share of the improvement this year.

Much work will be done on the East Michigan Pike and the West Michigan Pike, which are intended to serve respectively the eastern and western parts of lower Michigan,

A GRAVEL ROAD IN GRAND RAPIDS TOWNSHIP, KENT COUNTY, MICHIGAN.

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*Michigan State Highway Department.

and which, joined together at the apex of the lower peninsula, form the loop of the Dixie Highway. In the southern part, bond money available or to be voted upon in practically all the counties traversed by the Detroit-Chicago Highway is to be used extensively on this route. The Wolverine Pavedway, a cross-state highway, it is expected, will offer a nearly continuous improved road from Detroit to Grand Rapids at the end of the season. Upper peninsula counties, too, are active. Already the Cloverland Trail throughout the length of the upper peninsula offers one of the longest stretches of improved road in the state. Additions to this and other important trunk lines will be made during 1917.

The foregoing is in addition to the building work that will be done under the Covert or assessment district act, which provides for road construction upon the petition of persons representing 51% of the frontage along a road at least 2 mi. in length, a portion of the cost of which is assessed upon the property benefited. It is safe to say that more than $1,500,000 in cash is now deposited in the banks of Michigan to continue the construction of roads under this act during the season of 1917.

There are at present assessment district petitions on file with the State Highway Department from counties not under the county road system aggregating approximately 1,000 mi. of road. Some of the counties have proceeded to the point of letting contracts, but no more has been done, owing to the inability of the state to sell the bonds for construction. The legislature has amended the act and it is thought that purchasers will be readily secured. If this proves to be the case a very appreciable portion of the thousand miles will be constructed this season. Some of the roads started under the Covert act and much of the mileage applied for to the State Highway Department are on important trunk line routes. A large share of the Huron Shore Drive in the "Thumb" is petitioned for under the Covert act.

The construction of a small but important mileage of federal aided roads will also be started this year if projects which have been submitted to the Secretary of Agriculture are approved by him. A total of about 40 mi. is proposed to fill gaps on the East Michigan Pike, while a road across Baraga County is intended to connect the lower part of the upper peninsula with the copper country. It is expected that the federal aid law will be of great assistance to the state in filling in gaps on important trunk line routes where the communities are too poor to build the roads under the present state aid law.

New Highway Law in New Mexico

A law passed at the 1917 session of the New Mexico Legislature and approved on March 10 reorganizes the State Highway Department and makes various changes in the method of administering state highway work. Under the portion of the law providing for the organization of the commission, Governor DaBaca has appointed as commissioners Charles Springer of Cimarron, Eugene Kempenich of Hearalta and W. M. Atkinson of Roswell. The commissioners met recently, elected Mr. Springer president and Mr. Kempenich secretary, and designated State Engineer James A. French as State Highway Engineer. Under the section providing for the classification of the commission by lot, Mr. Springer was chosen to serve for two years, Mr. Kempenich for four years and Mr. Atkinson for six years. The chief provisions of the law are as follows:

Section 1 creates a state highway commission composed of three members, appointed by the governor, with advice and consent of the senate. All of the commissioners must be residents of the state and no two may be residents of the same judicial district nor belong to the same political party. The members of the commission receive $8 a day while actually engaged in the discharge of their duties and also their expenses while traveling on the business of the commission. The commissioners, however, may not receive compensation or expenses for a total of more than 90 days during any one year.

Section 2 provides that the commissioners shall serve for six years, one being appointed every two years. It also provides that:

> Within thirty days from their appointment they shall qualify, organize and elect a president and secretary. They shall classify themselves by lot so that one of them shall hold office until two years, one until four years and one until six years from and after January 1, 1917. And thereafter one commissioner shall be appointed each two years.

Section 3 provides that the commission shall appoint a state highway engineer to have general charge of the work of the commission. He must be a competent civil engineer "experienced and skilled in highway and bridge construction and maintenance." His salary is to be fixed by the commission and he is allowed his necessary expenses while engaged in the discharge of his duties. He is obliged to execute a bond of $50,000, the premium of which is to be paid from the state road fund. He is to hold office during the pleasure of the state highway commission.

It is also provided that the commission may designate the state engineer as the state highway engineer, in which case he must perform the duties of state highway engineer in addition to those of state engineer and receives while acting as state highway engineer a salary of $1,000 a year in addition to his salary as state engineer.

Section 4 provides that the state highway commission and the state highway engineer shall be furnished with offices in the Capitol and that the offices shall be under the charge of the state highway engineer.

Section 5 empowers the state highway engineer, with the approval of the state highway commission, to appoint and fix the salaries of assistant engineers, clerks and such other assistants as may be necessary.

Section 6 provides for the holding of meetings of the state highway commission and empowers the commission to consider and determine at its meetings all questions relating to the general policy of the commission and the conduct of its work.

Section 7 defines the duties of the state highway engineer. It provides that he shall keep records of the work of his office and of the state highway commission, that he shall keep on file copies of all plans, specifications and estimates prepared by his office, that he shall have made and filed in his office a general highway plan of the state, that as soon as practicable after the law goes into effect he shall prepare or have prepared maps showing all of the main highways of the counties and shall, under the direction of the state highway commission, select and designate those highways that shall comprise a system of state roads. These must be as nearly as practicable those which will "best serve the traffic needs and develop the resources of the state." The system of roads designated in this manner may be changed by the state highway engineer, with the approval of the state highway commission. The state highway engineer is also charged with the duty of collecting information relative to the mileage, character and condition of the highways and bridges of the state and must investigate and determine the methods of construction and maintenance best adapted to conditions. The state highway engineer may at all reasonable times be consulted by county and other road and bridge officials. The state highway engineer is empowered to call upon county road officials and county surveyors for information relative to the highways and bridges within the jurisdiction of the local officials and it is provided that any official who fails to supply such information when requested to shall be guilty of a misdemeanor, upon conviction of which he shall be subject to a fine of not less than $10 nor more than $100. The state highway engineer is given power to determine the character of and have supervision over the construction, repair and maintenance of all state roads and bridges improved under the provisions of the act and must prepare or approve all plans, specifications and estimates for such work. He is also obliged to report annually to the state highway commission. This section also provides that money in the state road fund may be expended only upon itemized vouchers provided by the state highway engineer.

Section 8 prescribes the method to be followed by county officials in securing state aid. Whenever the county commissioners of any county desire the improvement or construction of any road included in the system adopted by the state highway commission they must make written application to the state highway engineer. If they fail to make such application during any year in which aid is available the county forfeits its right to its allotment for that year and the funds apportioned to it revert to the state road fund and may be used for work during the succeeding year. The state highway commission may approve of an application for state aid and may undertake the work in accordance with the provisions of the act. The application having been approved, the surveys, plans, specifications and estimates are made by the state highway engineer. This section also empowers the state highway engineer to proceed with the improvement of any road in the system of state roads which the state highway commission deems it advisable to improve, without application for such improvement from the county commissioners of the county in which the road is situated. In such case the entire cost of the improvement must be paid from the portion of the state road fund made available for expenditure wholly within the discretion of the state highway commission and from the state apportionment of federal funds.

Section 9 provides that work costing $1,000 or less may be done by force account or by contract, at the discretion of the state highway engineer and state highway commission, but that when the cost exceeds $1,000 the state highway engineer must award a contract for it after advertising for bids. The state highway engineer is empowered to reject any or all bids "if they are unbalanced, or for any other good reason," but otherwise must award the contract to the lowest responsible bidder "subject to approval by the board of county commissioners where county funds are involved." If no satisfactory bid is received new bids may be called or work may be done without awarding a contract.

Section 10 provides that contracts for work under the act must be made in the name of the State of New Mexico and signed by the state highway engineer and the board of county commissioners or other proper authority of the county participating in the work and by the contracting party. No contracts may be awarded that will create a liability on the part of the state in excess of the funds apportioned to or otherwise available for use in the county in which the work is situated.

Section 11 provides that partial payments may be made as the work progresses and that no more than 85% of the contract price may be paid in advance of the completion of the work and its acceptance by the state highway engineer.

Section 12 provides that rights of way may be acquired by the counties by donations, by agreements with owners or through the power of eminent domain.

Section 13 defines bridges, culverts and other structures on a highway as parts of the highway. It also provides that not more than 50% of the cost of construction or improvement may be paid by the state and not less than 50% by the county in which the work is done except when the work is done by the state highway commission without the use of county funds.

Section 14 provides that all state highway constructed or improved under the provisions of the act shall be maintained by the state highway commission and that not more than 50% of the maintenance cost shall be paid by the state and not less than 50% shall be paid by the county. The state highway commission may contract with the county commissioners to maintain the state highways and upon their failure to do such work may have it done and charge the county's portion of the cost to the allotment to the county from the state road fund for the year in which the work is done. This section also authorizes the state highway commission to make rules and regulations for the location of pipe lines, poles or railways in roads improved under the act.

Section 15 provides for an annual tax levy of not over one mill on a dollar on all taxable property in the state to take the place of the similar tax authorized by Section 2642 of the Codification of 1915. The proceeds of this tax together with one-half of the net revenues from the licensing of motor vehicles and all fines and penalties for the violation of such laws are to be paid into the state road fund. After providing for interest and sinking fund for state highway bonds, the state highway commission must reserve out of the state road fund a sufficient sum annually to cover the expenses of the commission, including the salaries of officers and employees, to pay the state's portion of the cost of maintaining all highways constructed by them or which are included in the state road system, provided, however, that not less than 20% of the funds made available by the act shall be expended in the maintenance of roads and the balance of the fund must be expended by the state highway commission in the construction and improvement of highways under the provisions of the law in the following manner:

> Of such balance a sufficient sum shall first be set apart annually to pay the interest and the principal of any certificates of indebtedness that may be issued under the provisions of Section 16 hereof, as the same shall severally become due, and the remainder of such fund shall be used, as provided in Section 19 of this act, to equal the federal funds apportioned to the state; and not less than 75% of the remainder of such balance shall be expended by the said commission in each of the several counties of the state in proportion to the assessed valuation of all property therein, exclusive of that in cities or towns having a population of more than two thousand, as shown by the latest available federal census: Provided, that the state and federal funds expended on any road or roads, constructed or improved under the provisions of Section 19 hereof, shall be charged against any apportionment of such funds to which the county wherein such road or roads may be located, may be entitled.

It is also provided that the tax levy authorized by this section shall be excepted from the provisions of Section 12, Chapter 54 of the general laws of New Mexico for the year 1915.

It is also provided that not more than 7½% of the estimated cost of any work of construction, repair or maintenance by state aid shall be charged to administration and engineering expense.

Section 16 provides that under certain conditions the state highway commission may anticipate the proceeds of the tax levies by issuing certificates for such periods not exceeding two years as the commission may determine. These certificates must bear interest at a rate of not over 5% per annum. Subject to these limitations the commission may issue certificates "only in such amounts as shall be necessary to fully carry out and meet the provision of the act of Congress approved July 11, 1916, and known as the 'Federal Road Law,' and to provide amounts sufficient to equal the sums which may be available to the State of New Mexico under such law."

Section 17 provides that the state highway engineer, with the approval of the state highway commission, may use state or county convicts for highway work. The value of the labor so used must be computed and credited to the state or county, as the case may be.

Under Section 18 the control of roads in the various counties except those included in the state highway system is vested in the boards of county commissioners. It is also provided that the state highway commission shall employ a county superintendent in each county of the state or may employ one such superintendent for two or more counties. The salaries of these superintendents are to be fixed by the commission, but must not exceed $166.66 per month "nor 10% of the amount of the estimated proceeds of the county road levy or levies in the county or counties by which he is employed." The salaries are paid by the counties, the portion to be paid where the superintendent is employed by two or more counties being determined by the state highway commission. The county highway superintendents are empowered to supervise and direct construction, maintenance and repair work on all roads and bridges within the counties in which they are employed subject to the general control of the county commissioners.

This section also provides that all work not done under the supervision of the state highway commission shall be let by contract by the county highway superintendent subject to the approval of the county commissioners. If satisfactory bids cannot be obtained the work may be done by force account.

This section also provides for the raising of funds for carrying out county road work. The county road fund comprises all funds received by the counties from taxation, the issuance of bonds, gifts or any other sources, for road and bridge work. Provision is also made for the setting aside by counties, from the county road fund, of a special fund for road and bridge work, its amount being based upon an estimate furnished by the county highway superintendent and approved by the board of county commissioners. All expenditures from the county road fund must be accounted for in accordance with the uniform accounting system prescribed by the state highway commission.

Provision is also made in this section for the preparation of highway maps of the counties in accordance with the specifications of the state highway commission. A copy of each such map must be filed with the state highway commission and with the county clerk.

Section 19 assents to the federal aid law and authorizes the state highway commission to make contracts and agreements with the U. S. Government relative to the construction and maintenance of rural post roads under the federal aid act.

Section 20 authorizes the state highway commission to make rules and regulations necessary for the carrying out of the provisions of the act.

Section 22 authorizes the boards of county commissioners to make agreements with the Secretary of Agriculture for work under Section 8 of the federal aid law.

Section 23 permits boards of county commissioners to levy taxes to provide funds for carrying out agreements made with the Secretary of Agriculture.

Section 24 permits boards of county commissioners to levy and collect a tax of not over two mills on each dollar of taxable property to provide funds for carrying out the provisions of the act. The boards of county commissioners are also authorized to anticipate the revenues derived in this way by issuing certificates bearing interest of not over 6% per annum in amounts not in excess of the estimated returns of the levies authorized.

Four-Year Road Program in Freeborn County, Minnesota

Authority for the expenditure of $213,000 on the construction of roads in Freeborn County, Minnesota, during the four-year period from 1917 to 1920, inclusive, was given by a resolution adopted recently by the Board of County Commissioners. To this will be added other sums necessary for maintenance. The money will be distributed on state road work as follows:

Year	Road	Amount
1917	No. 1, Jefferson Highway, Albert Lea city limits to Steele County line	$46,000
	No. 13, Glenville east to Myrtle and London	10,000
1918	No. 7, Albert Lea city limits south to Knatvold creamery, and on No. 8, from South Broadway west to Eberhardt schoolhouse	25,000
	No. 2, from Hatch bridge north	5,000
	No. 6, Albert Lea city limits west to work completed south to Alden	15,000
1919	No. 4, Jefferson Highway, Albert Lea city limits to state line	10.000
	No. 2, Albert Lea to Hartland	15,000
	No. 3, Albert Lea to Austin	10.000
	No. 5, Alden to Mansfield	15,000
1920	No. 14, Jefferson Highway, Geneva east to Red Ball route	15,000
	No. 8, Pickerel Lake and Nunda townships to Emmons	15.000
	No. 7. Knatvold to state line	10.000
	No. 9, Bath and Hartland to Ellendale	6,000
	No. 16, from the Jefferson Highway to Lerdal creamery and east	8,000
	No. 12, Alden to Freeborn	8,000

Proposed New Highway Law for the Province of Ontario

A bill providing for the establishment and improvement of a system of provincial highways has been introduced in the legislature of the Province of Ontario, Canada, and, it is stated, will probably be passed at the present session. The measure confers broad powers upon the provincial highway authorities and lays upon the provincial treasury a large share of the cost of the proposed work.

By the terms of the bill, the provincial government, upon recommendation of the minister of public works and highways, may designate roads as "provincial highways" and proceed to construct, improve and maintain them. The cost of both construction and maintenance will be borne by the province in the first instance, but 30% of the cost, exclusive of the expenses for plant, surveys, overhead and the acquirement of additional land for relocating, widening or other purposes, must be repaid by the municipality in which the work is done. Under certain conditions, also, a portion of the cost of any improvement may be charged to a municipality at a distance from the road improved but benefiting by the improvement, a portion may be charged to a county, or assessments may be made against abutting property.

All work done under the act is to be under the control of the Department of Public Highways. The department is also vested with power to regulate public utilities upon provincial highways and to make traffic rules and regulations.

The Building of a Graveled Pike from Harrisburg to Marked Tree, Arkansas, a distance of 20 mi., will probably be undertaken during the summer and fall of 1917. Work is now in progress on about 5 mi. of road, which, it is said, will open up a rich farming section.

The Roads of Washington would not hold up under the heavy traffic of military motor trains and the transportation of troops, according to Capt. Wm. T. Patten in a paper read at the annual Road Builders' Institute at Seattle. To show the enormous weight highways would be subjected to, he gave statistics based on the army division, which consists of 22.000 men, about 7,500 animals and 900 vehicles. The division would transport 2,160,000 lbs. with it. This total does not include the weight of the carriages or troops. Good roads are doubly essential for the transportation of military equipment by motor, he said, calling attention to the rapid breaking down of the trucks in the expedition into Mexico. The same trucks were giving good service in Europe because the roads were good, he declared.

The Relation of Public Schools to Road Improvement[*]

By J. D. EGGLESTON[†]

I believe it would be impossible to say anything new on this subject; certainly, in Virginia, although a great deal needs to be done in the country districts to improve the roads in order to improve the schools, and to improve the schools in order to improve the roads.

I recall that we started a campaign in 1906, when I became state superintendent of public instruction, for the consolidation of schools and the transportation of school children, and that we talked good roads as much as we did good schools; and in fact, talked both all the time.

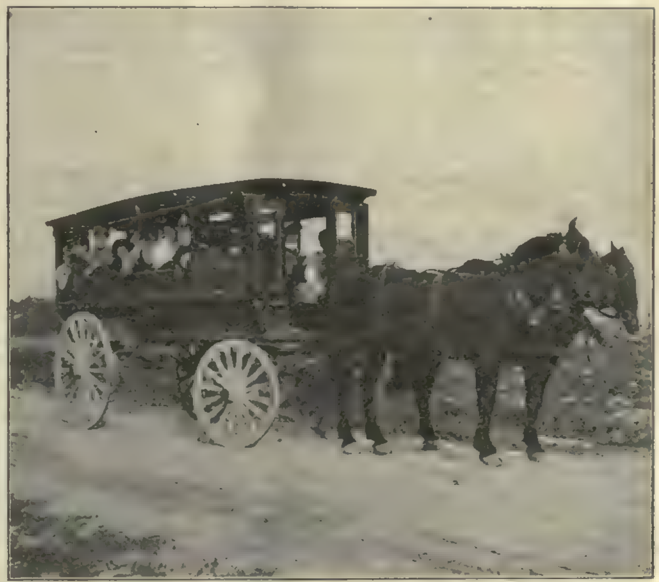
It was fortunate that the General Assembly of 1906 passed an act appointing a highway commission and putting the building of roads on a definite basis. It was fortunate that the same General Assembly passed acts looking toward the consolidation of schools and the encouragement of country high schools centrally located and aided by the state. It was a happy conjunction that the state at the same time decided to assist in road building and also to assist in the building of centrally located consolidated high schools. Each measure helped the other when we went into the campaign that spring, and since that time there has been a steady improvement, both of country schools and of country roads.

ONE-ROOM SCHOOL HOUSE FOR COLORED CHILDREN—SITUATED ON AN UNIMPROVED ROAD.

By consolidation of schools I mean, of course, taking a few one- and two-room schools, locatel here and there in a community, and building a centrally located school to take the place of these scattered little schools. A great deal of this has been done in the last ten years, and a very great deal is yet to be done.

Of course, when we started the agitation for breaking up the little one-room schools and building the central schools, there was great opposition. The people had not learned the advantages of the central graded school, with from three to eight teachers, over the small scattered schools, with one teacher each, and they felt at first that we were simply going to transfer the one-room school to a longer distance from their children. But outside of the opposition which came for the reason mentioned, the greatest obstacle that confronted us in the way of an argument was the condition of the country roads. And if in many sections of the state the country roads are bad now, what language could describe them ten years ago? In fact, I was told throughout the state that the school people should wait until the people had better roads before we attempted to have the centrally located schools to which the children either had to walk or to ride for a longer distance. My reply was that if we waited until we could get good roads throughout the state we might have to wait until Gabriel blew his trumpet, and that we school people believed that if we forced the issue the new central schools would bring about good roads probably more quickly than any other argument that could be used. The fact was that I hardly knew myself whether a centrally located school was a better argument for a good road than a good road was for a centrally located school. The argument seemed to be on a par with the never-answered question: "Which came first, the hen or the egg?" And the answer in both cases is "Yes."

The limit of this talk will not permit me to name instances in which, after the people had waked up and built miles of good roads, agitation at once started for these central country high schools on the ground that the children could easily get to the school, nor have I time to mention numbers of instances where, after a centrally located school was erected, the children and people at once began an agitation for better roads over which they might get to this school.



TYPE OF VEHICLE USED TO CARRY CHILDREN TO A CONSOLIDATED SCHOOL IN VIRGINIA.

I remember some years ago saying that there were ten objections to the consolidation of small schools into a centrally located school and to the transportation of the children in wagons, and that eight out of ten of these objections were imaginary. I said at the time that the two real objections were bad roads and sparsity of school population. I also said at that time—and it will do no harm to repeat it—that: "Good roads and good schools should go together, but since neither exists in many of our communities the advocates of good schools have gone right ahead and consolidated, knowing from the experience we have already had that good roads will follow." And this diagnosis was correct. The truth is that I know of hardly an instance where we erected a central country high school before there were good roads that the children and patrons did not force the road question to the front to such an extent that better roads soon followed as a result of the centrally located school, and I really take some pride in the fact, gentlemen, that I requested superintendents and supervisors of schools throughout the state to stir up sentiment for better roads at every opportunity, to form good roads associations, and to do everything in their power to bring about an improvement in the public roads on the ground that it meant more country high and graded schools, more regular attendance of country children at the schools, and a larger percentage of children attending the schools.

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[*] Paper presented at the 1917 annual meeting of the Virginia Road Builders' Association at Norfolk, Va.

[†] President, Virginia Polytechnic Institute.

I think it is worth while to give one very striking instance of how good roads followed a new centrally located graded and high school:

This incident occurred in Prince Edward County in the Green Bay district. There was a very wide-awake school trustee living at Green Bay, and he made up his mind that, as the little one-room schools scattered in and around Green Bay were so poor, the conditions could not possibly be worse if some of them were closed and a new graded and high school were located at Green Bay as a center, and wagons used to haul the children in from outlying communities as far as five miles away.

The roads were indescribably bad. The soil is the red clay soil of southside Virginia, and there were times in the winter when these roads were bottomless. I have traveled over them when they were in this condition, and have been compelled at times to go on horseback because no vehicles could get through them. Mr. Jones had never seen ready-made school wagons, and he took for granted that if they were strong enough for other sections of the country they were strong enough for the Green Bay district. He did not take into consideration that the roads around Green Bay were so much worse than in other sections of the country. So he purchased two transportation wagons, and in not less than six weeks they had practically gone to pieces. In fact, when a pair of mules got into an enormous mud puddle with one of these transportation wagons, and were told to get out of the puddle, they got out with about one-third of the front of the wagon, leaving the other two-thirds of the wagon and the children stranded. The average man after such an experience, would have given up and declared the wagon plan impracticable, but Mr. Jones was not an average man, nor is this world's progress made by the average man. Fortunately for the children of his district, he not only had brains, but the welfare of the children was with him a consuming passion. He got on the train and went to Farmville, bought two stout farm wagons, giving $40 apiece for them. He bought what is known as the "common sense springs" and attached them to the wagons to relieve the hard jolt somewhat. He put the bodies on; had seats made; had bows made and fastened to the bed, and bought some good white canvas and had it tightly fastened over the bows. The total cost, including the wagon, was $60 each. He had no further trouble in getting the children to school. All the trouble fell on the good pairs of mules and horses that were secured for doing the pulling.

These wagons were not much for style, but they did the work. I have mentioned this experience of Mr. Jones for two purposes. One is to show that where there is a will there is a way, even if the way is very muddy. My other reason is to bring out a striking incident of how this centrally located school forced the issue of good roads to the front.

The children who rode to school in these wagons would return home and grumble so much about the bad roads that they soon had their fathers' nerves on edge, and in a few months a meeting of the citizens of the school district was held, embracing a radius of five miles in every direction, at the central school. After many very uncomplimentary remarks about the condition of the roads and about the necessity of having good roads to get the children to this good graded and high school, a resolution was offered, calling upon the board of supervisors to raise the road tax in that district, and to build some first-class roads in every direction, starting at the new school as a center.

Some of you may not see the significance of this, because good roads are quite the fashion now, but back in 1906-1907 this action of the citizens of that district was looked on as little short of miraculous, and was commented on in the papers far and wide.

The result of this agitation was that the good roads were built, and today there is little difficulty for the children for many miles around to get this central school.

I might mention many other instances, because many occurred. I mention this one not only because it is typical, but because there was an element of humor in the way in which Mr. Jones refused to be defeated when his ready-made transportation wagons were pulled to pieces, and overcame a seemingly impossible obstacle.

I might have mentioned that Mr. Jones got into a very heated argument with one of the patrons while all this was going on, and finished up the argument by giving him a good licking. He then appointed this man as one of the drivers for this transportation wagon, and "peace reigned supreme."

I may be pardoned in this connection for repeating that I know that the school people of the state have done able and efficient work in helping to bring the road issue to the front during the last ten years. You can readily see why they should have done so.

For example, take the Cooperative Education Association, which has been actively at work for the past ten years. This association cooperates with every movement in the state for the betterment of any community.

Here is what this association did last year: The school and civic leagues, of which there are about 1,200, and which constitute branches of this association, had last year a good roads day. The association sent out 5,000 good roads programs to the school and civic leagues and to the public schools in the country districts. Two hundred and forty-five school and civic leagues, representing 75 of the 100 counties in the state, reported special celebrations and meetings on that day, with an attendance of nearly 16,000 people. Two hundred and nine addresses were delivered on the subject of good roads; 324 days' work were subscribed by the league members for work on the roads; ditches were dug, and pipes were laid to carry off water. Compositions were written by school children, debates were held on such subjects as "Bond Issues for Good Roads," "How to Improve Good Roads," "How to Obtain Federal and State Aid for Roads."

A number of leagues improved the roads leading to the schools. In several villages concrete walks were laid and mud holes filled. A considerable number of farmers agreed to drag the roads at regular intervals.

This kind of thing has been going on for years, initiated and conducted by school people.

May I be pardoned for mentioning one other incident which, while it does not bear immediately upon the matter of good roads, has an element of humor in it that is too good to keep:

In one county in Virginia several years ago the school trustees decided to close a small one-room school and establish a transportation wagon to haul the children to a new centrally located school. There was a widow who lived about three-quarters of a mile from the one-room school which was to be closed and about three miles from the new central school. She employed a lawyer to try to prevent the trustees from carrying out their purpose of closing the one-room school, as she had a daughter who attended that school. She lost the case, and at first reluctantly sent her daughter in the transportation wagon to the new school. She soon became very much pleased with the progress that the child was making in the graded school. At the beginning of the next session, owing to financial stringency, there was some talk in the neighborhood of taking off the wagon and reopening the one-room school for the usual short term. The widow at once employed the same attorney to prevent the school trustees from taking the wagon off. All of which goes to show that it is not safe to interfere with a woman's prerogative of changing her mind.

The effect of good roads on land values is a matter that bears directly on school improvement. It is a well known fact that good roads in a community cause an almost immediate rise in land values, because they are also a direct invitation to people from the outside to come in and purchase lands, to settle upon them, and to build. All of this of course makes for more property to be taxed, and, therefore, for increased revenues for school purposes. This, in turn, enables the school officials to build better school houses; to pay better salaries, and, therefore, secure better teachers; and to lengthen the school term.

If anything will produce a howling wilderness, it is the combination of bad highways and poor schools. If anything will build up a neighborhood with good citizens, it is the combination of good roads and good schools.

New Wyoming Road Law

Among other laws that have been enacted by various states for the purpose of creating a state highway commission and assenting to the provisions of the federal aid road bill passed in July of last year is that of Wyoming, whose recent legislation in the form of House Bill No. 153 is presented herewith. Because of its brief yet comprehensive character it is possible to print the larger portion of the law in the following extracts:

Section 1. There is hereby created a State Highway Department, to consist of a State Highway Commission and a State Highway Engineer, who shall act as secretary of the commission. The said commission shall consist of five state highway commissioners, who shall biennially elect their chairman. The said commissioners shall be appointed by the Governor, by and with the advice and consent of the Senate, and each shall serve for the term of six years; provided, that upon the passage of this act the Governor shall appoint two commissioners for the term of two years, two commissioners for the term of four years, and one commissioner for the term of six years. Not more than three of said commissioners shall be affiliated with the same political party, and one commissioner shall be appointed from each (of) the following described districts: District No. 1, composed of the counties of Laramie, Albany, Platte, and Goshen; District No. 2, composed of the counties of Carbon, Sweetwater, Uinta and Lincoln; District No. 3, composed of the counties of Niobrara, Converse, Natrona and Fremont; District No. 4, composed of the counties of Hot Springs, Washakie, Big Horn and Park; District No. 5, composed of the counties of Sheridan, Johnson, Campbell, Crook and Weston. If any commissioner shall cease to be a resident of the district from which he is appointed his office shall be vacant; all vacancies from any cause shall be filled by appointment by the Governor for the unexpired term. Each of said commissioners shall qualify by taking the constitutional oath of office and each shall receive a salary of $600 per year and his actual and necessary traveling and living expenses while away from his home in the performance of the duties of his office, to be paid from the "state highway fund" hereinafter provided. The commission shall maintain offices in the state Capitol which shall be in charge of the State Highway Engineer. * * * * * The Attorney General shall be the legal advisor of the commission and shall prosecute and defend all action and appear in all proceedings in any federal department in which the commission shall be a party or be interested.

Section 2. The commission shall appoint a State Highway Engineer to serve until removed by the board, with a salary to be fixed by the commission, payable in equal monthly installments. He shall be a competent civil engineer, experienced and skilled in highway construction and maintenance; shall be allowed his actual and necessary traveling and other expenses incurred in the discharge of his official duties, and shall give his entire time to the duties of his office. * * * * * Under the supervision of the commission he shall have complete charge of laying out and establishing highways upon which any portion of the state highway fund is to be expended and with the approval of the commission shall purchase all materials, supplies and equipment, including road building machinery, materials, supplies and equipment, and shall employ such engineers, superintendents and employees, with salaries to be approved by the commission, as may be necessary for the proper performance of the duties of the commission and the construction work undertaken by it.

Section 3. The Legislature of the State of Wyoming hereby assents to the provisions of the Act of Congress, approved July 11, 1916, entitled "An Act to provide that the United States shall aid the states in the construction of rural post roads, and for other purposes." The State Highway Commission is hereby authorized to enter into all contracts and agreements with the United States Government relating to the construction and maintenance of rural post roads under the provisions of the said Act of Congress. * * * * * The good faith of the state is hereby pledged to make available funds sufficient to equal the sums apportioned to the state by or under the United States Government during each of the five years for which federal funds are apportioned by the said act and to maintain the roads constructed under the provisions of said act, and to make adequate provision for carrying out such maintenance. For each of the years 1917 and 1918 there shall be levied upon all taxable property within the state a state tax of one-quarter of a mill upon each dollar of assessed valuation, and the proceeds of such tax shall constitute the state highway fund, to the credit of which there shall be placed all amounts received from the United States under said act by the State Treasurer, who is hereby designated as the state official to receive such funds, and to the credit of which there shall be placed all other sums donated or by law appropriated or designated as belonging to such fund. All expenditures from said fund shall be made upon the warrant of the State Auditor, issued upon voucher approved by the chairman of the commission.

Section 4. The commission shall from time to time designate the highways to be constructed or improved in cooperation with the Secretary of Agriculture. Before any such highway is finally designated the commission shall require and the board of county commissioners of each county in which any portion of such highway shall lie shall appropriate from county funds an amount sufficient to pay one-half of the cost of the proposed work within that county, and one-half of the cost of such work shall be paid from the state highway fund and one-half of the cost from the county funds, upon warrants drawn by the respective boards of county commissioners upon vouchers issued or approved by the commission. After providing for the payment from the state highway fund of the proportion of the cost of such construction to be paid from said fund, the commission shall annually appropriate from said fund such sum as may be necessary to pay all of the expenses of the commission, including salaries and the purchase of materials and equipment; the commission shall then appropriate from said fund such amount, not exceeding one-quarter of the balance remaining therein for the year, as the commission shall consider necessary for the payment of expense of emergency construction and repairs and for additional aid to the counties needing the same, and this amount shall be expended within the discretion of the commission for such purposes; the remainder of the said fund for the year shall then be appropriated for the construction of other highways than those in the construction of which the Secretary of Agriculture shall cooperate. Such highways shall be designated by the commission in conjunction with the respective boards of county commissioners, and before such designation the respective boards of county commissioners shall appropriate from the county funds an amount sufficient to cover one-half of the cost of such improvement, which amount shall be paid out upon warrants issued by the respective boards of county commissioners upon the voucher of the commission. For the purpose of constructing a road or bridge upon the line between two counties the two counties and commission may enter into an agreement subject to the provisions of this section.

Section 5. All road and bridge construction work, any part of the cost of which is paid from the state highway fund, shall be performed in accordance with the plans and specifications prepared by the State Highway Engineer, and approved by the commission, and shall be performed by or under contracts awarded by the commission, and the State Highway Engineer shall have complete charge thereof. All improvements costing more than $2,000 shall be constructed upon contracts awarded to the lowest responsible bidder after public notice, and improvements costing less than $2.000 may be constructed by the commission upon force account, upon private contract, or upon contract awarded upon public notice, as the commission may determine. The commission shall adopt general rules regulating the publication of notice to bidders and the awarding of contracts.

Section 6. It shall be the duty of the State Highway Engineer to compile all available information relative to the public roads and bridges within the state and for this purpose he may require the board of county commissioners of any county to cause to be prepared comprehensive maps to be filed in the department; he shall prepare standard plans and specifications for the construction of roads, culverts and bridges, and compile data relative to road and bridge materials and their values, and for this purpose may call upon the Department of Civil and Irrigation Engineering of the State University to make tests of road and bridge materials without charge; and he shall furnish such plans, specifications and data to any board of county commissioners upon request, and shall advise with such boards with respect to highway construction and improvements not within the jurisdiction of the department and shall prepare special plans and specifications for such work when requested. He shall prepare plans and specifications for all bridges to be constructed by any county, city or town within the state the cost of which shall exceed $200, or the span of which shall exceed 5 ft., and no contract for the construction of such a bridge shall be valid unless the plans and specifications therefor have been prepared or approved and the contract approved by the State Highway Engineer, and no payment upon any such contract shall be made until such bridge shall have been examined and the payment approved by the said engineer or his assistant.

Section 7. Every road hereafter constructed or improved by the State Highway Department shall constitute a state highway and it shall be the duty of the board of county commissioners of every county to maintain and keep in repair all state highways lying within their respective counties. The State Highway Engineer shall from time to time examine said state highways and inform the proper board of county commissioners as to the extent and character of the work of maintenance and repair to be performed thereon, and if the board of county commissioners shall fail within 30 days after such notice to perform the necessary work of maintenance and repair, the commission shall withhold all funds then apportioned or thereafter to be apportioned from the state highway fund for expenditure within such county, and no funds shall be expended therein until said requirements of the State Highway Engineer shall have been complied with. The commission shall also have the power if it shall so decide, and with respect to highways constructed by agreement with the Secretary of Agriculture it shall be its duty, to perform the required work of maintenance and repair, using the state highway fund therefor, and the cost of such work shall thereupon be charged against the delinquent county and no funds shall be expended therein until such amount has been repaid to the state highway fund.

Section 8 of the measure defines the duties of the board of county commissioners in relation to securing rights of way for roads to be constructed as provided in Section 4, and provides that if any such right of way can not be acquired excepting by condemnation proceedings, the State Highway Commission shall file with the board of county commissioners its request for the securing of such right of way, and the board shall then conduct such proceedings.

Section 9. The commission may prescribe uniform methods of cost accounting for the construction of roads, and may require the several counties to adopt such method. It may also prescribe requirements governing the issuance by the State Highway Engineer of certificates of competency to persons who may be employed by the counties as foreman or superintendent in charge of the construction of highways by the counties, and may prohibit the several counties from employing for such purposes any person not the holder of such certificate. The commission may refuse to expend any portion of the state highway fund within any county not complying with the provisions of this section.

Section 10. The State Highway Engineer shall make an annual report to the commission of the transactions of the department, and on or before Dec. 1 of each even numbered year the commission shall make a report to the Governor, and may cause the same to be printed, the cost to be paid by the state highway fund.

The act does not affect any contracts in existence at the date of its passage, repeals any previous laws that conflict with it, and takes effect at once.

The five members of the State Highway Commission appointed by the Governor are: Gus Holmes, Cody; Robert D. Carey, Careyhurst; F. C. Williams, Sheridan; Jos. Kinney, Cokeville; M. R. Johnston, Wheatland.

Trunk Line to Encircle Long Island

The completion of a trunk line around Long Island is reported to be the plan of the New York State Highway Commission. To carry out this plan it will be necessary to fill in a few gaps here and there, and these stretches are on the list which has been approved for construction.

On the North Shore work on the connecting link between Port Jefferson and Riverhead is expected to be done this year. At the latter point it will connect with the road now being constructed from Southampton.

On the south side of the island there is a gap to be improved between Moriches and Quogue, which will then join the Bridgehampton-Devon Road when it is finished. The entire road from the Nassau County line to Amagansett will then be improved.

From Easthampton there is an improved highway through Sag Harbor, North Haven and Shelter Island to Greenport. It is stated that Greenport contemplates building a road to Riverhead, which is constructing concrete roads at its own expense, and that Southampton residents are planning to spend about $50,000 of their own funds on road construction during 1917.

Proposal to Double Motor License Fees in Illinois to Raise $60,000,000

The proposal to provide $60,000,000 for state-wide road improvement in Illinois by increasing the land tax in accordance with a bill before the legislature to submit the question of a 20-year bond issue to the people of the state at the 1918 election, is not favored by Gov. Lowden, who states that the taxes are now as high as the people will stand.

The Illinois Highway Improvement Association is behind a movement to secure legislation providing that the amount be raised by doubling the tax on automobiles—50% to be added when the measure becomes effective, and 50% on Jan. 1, 1920. There are 325,000 automobiles in the state, and it is estimated that there will be approximately 600,000 by 1920, and it is shown that the increase in fees would produce $145,000,000 in the next 25 years—an amount sufficient to take care of the interest and principal and leave a balance for maintenance and the building of additional roads.

Gov. Lowden approves of this proposed law, which it is understood, is receiving the support of automobile clubs and owners throughout the state.

Six Hundred Road Signs will mark the highway intersections on 225 mi. of improved roads in Kent County, Michigan, orders for their erection having been given by the County Road Commission.

The State of Washington has 42,000 mi. of highways, of which 5,500 mi. are hard-surfaced. The growth in agricultural wealth and the increase in population of the state during the past decade have been largely dependent upon the good roads which have been constructed in that time, according to Clancy Lewis, Secretary of the Washington Good Roads Association, who addressed the delegates to the Good Roads Institute recently held at the State University. He declared that the present improved mileage of the state has been the result of the years of construction, initiated in 1876 by the energy of Henry Yesler, who attempted to build a highway through Snoqualmie Pass.

GOOD ROADS

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Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

MARCH 31, 1917.

HIGHWAY DEPARTMENT ORGANIZATION

In any organization however large or small, there is usually some one individual who is the real head, who actually directs the organization's activities, though he may nominally rank no higher nor lower in authority than others. Indeed, he may be, and not seldom is, a subordinate in rank, title and compensation. The larger the organization and the greater the magnitude of the work it has to do, the greater the probability that one man can be found who is the real leader. In other words, the bigger the job the more likely it is to be a one-man job.

Every-day experience and observation will bear out this premise, and so will history. The great names that have come down through the years have come singly, not combined into partnerships, firms or commissions. The leaders of great movements, soldiers, statesmen, scientists had their aids and assistants, but almost without exception the responsibility for what of good or evil was accomplished has rested upon one individual. Doubtless in some instances the wrong man has been singled out, but that indicates merely a failure to distinguish the real leader and does not indicate that there was not someone who actually occupied that position.

With the foregoing in mind it is interesting to note the marked tendency of recent road legislation to put commissions of two or more members, at least nominally in charge of state highway work. In this issue are printed reviews of the new laws of Kansas, New Mexico and Wyoming. In Kansas the commission consists of three members; in New Mexico there are also three members, and in Wyoming there are five. The West Virginia law, reviewed in the issue of March 24, provides for two members. The new commissions of Missouri and South Carolina, note of which was made in last week's issue also, have five and four members respectively. The newly created commission of Texas will have three members and the reorganized Department of Public Roads of New Jersey has a commission of eight. The powers specifically conferred upon the commissions in these states vary, but in general the usual custom is followed of making the commissions responsible for the general policies of the departments and delegating the actual conduct to an executive officer not a member of the commission.

Commissions for the administration of road affairs in the various states have differed in the number of members, but have, as a rule, consisted of three members or have been single-headed commissions, and there has been no little discussion as to the relative merits of the two plans. A former state highway commissioner of New York once said at an A. R. B. A. convention: "There is no more reason for three highway commissioners than there is for three governors or three state engineers." Others in equally good positions to observe the workings of both plans have declared as strongly for the multiple-headed commission.

To a certain extent the question of how many members there should be in a state highway commission is one to be determined by local conditions. At the same time there are certain very decided advantages of the one-member commission and of the commission of two or more. One of the chief arguments for one commissioner is that he can do his work more expeditiously and efficiently, being unhampered by the necessity for consultation with others and free from the necessity for adopting compromise plans. The principal argument for the larger commission is that in the many questions requiring careful study the judgment of three or more men is better than that of one. It is also held that the people are more apt to have confidence in a number of men than in one man.

Unfortunately, the administration of road work is inevitably complicated by politics, and any plan for carrying on the work must be so drawn as to eliminate so far as possible the intrusion of political considerations into business and engineering problems. Two years ago it was argued in these columns that the best results were to be expected from a combination of the two plans—the administration by a single commission or by a commission of three or more—whereby the larger questions of general policy were decided by a commission of three or more members, the supervision of actual work being intrusted to an executive answerable only to the commission. Essentially this plan has been in force for a long time in many of the states and its results have been generally satisfactory.

GOOD ROADS AND GOOD SCHOOLS

While there is nothing new in the linking together of the good road and the good school, the interdependence of the two is well brought out in the paper by President Eggleston of the Virginia Polytechnic Institute, which is printed on other pages of this issue. He brings into his discussion of these two very vital matters not the arguments that have been made so many times that they hardly need repetition, but an account of personal experiences that should be far more convincing to any one not already satisfied as to the value of good roads and good schools in any community.

The man whose boyhood was spent in a city or town and to whom the "one-room" schoolhouse is not even a memory, cannot appreciate how great a handicap to education a "mud road" can be. Nor can he easily realize the gain in efficiency and economy made possible by the consolidation of several one-room schools into a centrally located graded school. A great many people, especially in the cities, have lately come to look upon the country road chiefly as a means to the enjoyment of the automobile, and are perhaps in danger of forgetting that the people who live outside of the centers of population have to use the country road in the goings and comings incidental to their everyday life—that great numbers of the children in the rural districts have to walk to school over the road in all seasons and in all weathers. Many people, too, lose sight of the fact that the really necessary highway work of the country—not including that required in cities and towns—is not the building of expensive automobile roads, but the improvement of the hundreds of thousands of miles of roads that lead from farm to farm and from farms to business and social centers.

People who have unconsciously acquired this viewpoint should read President Eggleston's paper.

Highway Legislation in Kansas

In conformity with the requirements of the federal government contained in the act providing that the United States shall aid the states in the construction of certain classes of highways, the State of Kansas has passed such legislation as will enable it to take advantage of federal aid, at the same time creating a state highway commission and repealing a number of sections of the General Statutes of Kansas, Laws of 1915, relating to roads.

Under the provisions of the new law the state highway commission shall consist of three members as follows: the Governor, who shall be ex-officio chairman, and two members appointed by him, for terms of two and four years, respectively, and thereafter to be appointed for a term of four years, one of whom shall reside east of the sixth principal meridian and the other west thereof, no person being eligible for appointment who holds any elective or appointive public office. Each of the two members so appointed shall receive $5 a day for time actually spent in the performance of his duties, not to exceed $200 a year, and his actual and necessary traveling expenses. The commission shall appoint and fix the salaries of a secretary and a chief engineer, to be known as the state highway engineer, "who shall serve at the pleasure of the commission," and shall employ and fix the salaries of other engineers and assistants who may be necessary to carry on the work. Suitable offices shall be provided for the commission and for the state highway engineer and his assistants in the capitol building at Topeka, and the engineering testing laboratories of the Kansas State Agricultural College at Manhattan shall be at the disposal of the commission at all times.

The state highway commission shall have general supervision over the construction and maintenance of all roads, bridges and culverts, except the township roads for which federal aid is not granted; shall compile and furnish information to county and township highway officials; and carry on such highway educational work as it deems expedient. The law makes it the duty of county commissioners and county engineers to furnish detailed information concerning roads under their control to the state highway commission.

The board of county commissioners of each county within six months after the act becomes effective (March 7, 1917) shall appoint a competent county engineer for a term of two years, whose duty it shall be to prepare plans, specifications and estimates for roads, bridges and culverts to be built by the county or by the townships, and to act for the county in all matters relating to their construction and maintenance, or to rivers or watercourses for which the county pays a part of the cost thereof; to study soil conditions and collect information concerning the various deposits of gravel, stone, sand, clay and other road and bridge materials and to investigate and determine the most approved methods of using them; to make maps of the roads in the county and the different townships, and to hold two or more public meetings annually to advise with highway officials on road improvement.

The measure provides that where there is not a sufficient amount of county work to keep the county engineer employed throughout the year, the board of county commissioners, with the approval of the state highway commission, may unite with the commissioners of an adjoining county or counties, not to exceed six, and form a county engineer district and employ a county engineer for such district. In forming the district the extent shall be governed by the area, mileage of public roads, population, assessed valuation, and total amount of funds being spent in such counties for roads and bridges; no district to include more than $100,000,000 assessed valuation, the salary and expense of the engineer to be paid by the several counties on a percentage basis of population.

The salaries of county engineers, which are paid out of the general fund, are fixed as follows: Population 10,000 or less, not less than $1,200 per annum; population from 10,000 to 15,000, $1,300; 15,000 to 20,000, $1,400; 20,000 to 25,000, $1,600; 25,000 to 30,000, $1,800; more than 30,000, $2,000.

The law provides that on or before the 25th of July in each year the state highway commission with the county engineer shall inspect, or cause to be inspected, in each county of the state which has received or may receive federal aid in the improvement of roads, all government aid roads and certify to the board of county commissioners a detailed statement of work required and amount necessary to pay for the proper maintenance and repair of such roads during the year; and the board of county commissioners shall levy on all taxable property in said county a tax sufficient to raise the necessary amount, which levy shall be in addition to all other levies fixed by law, and the funds so collected shall be used only for the purpose specified.

As soon as practicable after the taking effect of the act the county engineers and boards of county commissioners shall classify and designate the roads in their respective counties, and in any county having 1,000 mi. of public roads or less, not less than 50 mi. nor more than 150 mi. shall be designated as county roads; in counties having more than 1,000 mi., not less than 10%, nor more than 15% shall be so designated; providing further that in counties having an assessed valuation of more than $50,000,000 not less than 100 mi. nor more than 25% shall be designated as county roads. All other roads are "township roads."

In designating the county road system, the law requires the county engineer to eliminate all steam or electric road grade crossings and all other dangerous places on such highways as far as practicable, by paralleling such lines, by undergrade or overhead crossings, or relocating the highways, or by other means, the expense to be divided equitably between the railroad company and the county or township. The commission may require suitable safety devices or warning signals to be placed at dangerous or obscure railroad crossings to indicate the approach of trains, which shall be installed and maintained by the railroad company.

A map of designated roads must be approved by the state highway engineer, and should he disapprove any part of the system as laid out, the county engineer is required to relocate all intercounty roads so as to properly connect with those of adjoining counties, and correct his road map accordingly. If any county shall fail to prepare and forward a map of designated roads to the state highway engineer within eight months after the act goes into effect, the state highway commission shall have the power to make the proper designation and charge the cost of same against the county road fund.

The county road system as laid out and approved shall be divided into sections, inspected and surveyed for permanent improvement, and when all the roads in the county system have been constructed in accordance with the plans the board of county commissioners may add such roads from the township road system as have been improved by the townships in accordance with the general plans and specifications furnished by the county engineer; and additional county roads may be added to the system, but no increase shall be made in the mileage until the county road system has been completed, unless by a majority vote of the electors it is decided to adopt the county as a road unit, in which case all roads and bridges shall be constructed and maintained at county expense, according to their relative importance.

A road tax for county roads of not less than ¼ mill nor more than 1½ mills on the dollar shall be levied on all taxable property by the boards of county commissioners in their respective counties for the improvemnt of county roads, provided that if it is deemed advisable to increase the levy, the proposition may be submitted to the qualified voters at a general election.

The law provides that the board of county commissioners may let contracts for all or any part of the work of constructing or maintaining county roads, or may buy the materials and contract all or any part of the labor, or may purchase or rent machinery and other equipment, and employ labor, under the direction of the county engineer.

The township board of highway commissioners shall have the general charge and supervision of all township roads and bridges, all work to be done in accordance with the plans and specifications furnished by the county engineer; and for the purpose of carrying out the provisions of the act the township board shall certify to the board of county commissioners on the last Saturday of July of each year the aggregate amount necessary for township road purposes for the next ensuing year, and the board of county commissioners at the time fixed by law shall determine the rate of levy necessary to raise the amount of money " by dividing the aggregate assessed value of the township outside of cities into the amount so to be raised and of the rate so obtained all decimals beyond hundredths of a mill shall be dropped out, but in no case shall the levy exceed three mills," unless authorized by a majority vote of electors. The rate so determined shall be levied on all property, real and personal, in the township outside of incorporated cities.

The act provides that in letting contracts, employing labor, or purchasing tools, machinery and materials, no member of the board of county commissioners, county attorney, county engineer, township highway commissioner, or any person holding an appointment under them, shall have directly or indirectly any personal pecuniary interest therein.

The county engineer is required to make a written annual report of work accomplished to the board of county commissioners.

The provisions of the act do not apply to the construction and maintenance of streets and highways within the corporate limits of cities, but do apply to all other roads and highways in the state.

Questions of Road Work in McKean County, Pennsylvania

The question of prosecuting the work of highway improvement in McKean County, Pennsylvania, under the $750,000 road bond issue approved by the citizens at the November election, was taken up with State Highway Commissioner Black at Harrisburg, March 15, by a delegation consisting of the County Commissioners and representatives of the McKean County Good Roads Association, accompanied by their respective solicitors.

It was explained that some doubt existed among the county commissioners as to the practicability of entering into a working agreement with the State Highway Department under the bond issue, the principal question being whether or not the commissioners would have any voice in the selection of the type of road to be built. Commissioner Black advised them that while the engineering supervision of the work would be exclusively under the jurisdiction of the department, the matter of types and methods of building would in each instance be submitted to the commissioners and thoroughly discussed before any contracts were awarded.

The McKean County Commissioners who attended the conference were A. M. March, Thomas Flaherty, and O. S. Gahagan. The Good Roads Association was headed by its President, Col. A. D. Burns, of Bradford, and a number of its members, including Chester King, its Vice President, and W. H. Bunce, its Treasurer, were in attendance.

NEWS NOTES

Swope Parkway from 49th St. to Meyer Blvd., Kansas City, Mo., is to be macadamized at an approximate cost of $117,000.

According to a Report, Perry County, Kentucky, will hold a road bond election on April 5, the amount of the bond proposal being $150,000.

The Proposed $6,000,000 Road Bond Issue for the State of Oregon is being strongly indorsed by commercial and other bodies throughout the state.

Muskogee County, Oklahoma, will decide the question of issuing bonds to the amount of $1,000,000 for the construction of roads and free bridges at an election on April 10.

An Election in Covington, Virginia, which has been called for April 9, according to a report, will decide the question of issuing bonds for $150,000 for paving the streets of the town.

An Election Will be Held in Utah County, Utah, on April 17, for the purpose of deciding whether or not the county shall issue bonds to the amount of $750,000 for road paving purposes.

The Resurfacing of South St., Indianapolis, Ind., between Virginia and Kentucky Aves., at an estimated cost of $70,769, is provided for in a resolution adopted by the Board of Public Works.

Photographs of Bad Roads, accompanied by information as to dates and localities, have been asked by the Champaign County, Illinois, Highway Improvement Association for use in its campaign to secure the issuance of bonds for road improvement.

A Scenic Road Connecting Greenwood Lake and Tuxedo, in New York State, is to be constructed in the near future, according to a recent report which states that the road will intersect the Bear Mountain Road at its junction, with the state road between Monroe and New York City.

An Improved Highway to Connect Lancaster, Pa., with Baltimore, Md., is being promoted by residents of the former city. A contribution of $1,000 to a fund for building the road has been made by the Lancaster Auto Club, and it is reported that state aid has been promised by Pennsylvania for carrying out the work within that state.

The Records of the Secretary of State of New York show that on March 17 there were 105,380 motor vehicles in the New York City district, which includes territory adjacent. This is an increase of 30,293 over 1916. Licensed chauffeurs in the district number 62,297. Fees and licenses collected at the date mentioned amounted to $1,309,375, as against $1,275,757 during 1916. The former amount is distributable as follows: Pleasure automobiles, 81,310; motor trucks, 20,361; omnibuses, 3,389.

MEETINGS

Calendar of Coming Meetings

April 10-14—Dominion Good Roads Association—Fourth Canadian and International Good Roads Congress, Horticultural Building, Ottawa, Ont., Can. Secretary, Geo. A. McNamee, 909 New Birks Building, Montreal, P. Q.

April 16-18.—Portland Cement Association—Spring Convention, San Francisco, Cal. Secretary, F. L. Page, 111 West Washington St., Chicago, Ill.

April 17-20.—U. S. Good Roads Association—Fifth annual convention, Birmingham, Ala. Secretary, J. A. Rountree, 1021 Brown Marx Building, Birmingham, Ala.

May 7-9.—National Conference on City Planning—Annual Conference, Kansas City, Mo. Secretary, Flavel Shurtleff, 19 Congress St., Boston, Mass.

June 11.—New York State Conference of Mayors and Other City Officials—Annual Conference, Buffalo, N. Y. Secretary, W. P. Capes, 25 Washington Ave., Albany, N. Y.

June 26-30.—American Society for Testing Materials—Annual meeting, Atlantic City, N. J. Secretary, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

Mayors' Association of South Atlantic and Gulf States

At the annual convention of the Mayors' Association of South Atlantic and Gulf States, held at Savannah, Ga., March 13-15, officers for the ensuing year were elected as follows:

President, Christian T. Hyde, Charleston, S. C.; First Vice President, R. O. Arnold, Athens, Ga.; Second Vice President, J. B. Ball, Quincy, Fla.; Third Vice President, J. W. McFord, Shreveport, La.; Treasurer, W. L. Douglas, Charleston, S. C.; Secretary, George R. Herbert, Savannah, Ga.

Fourth Canadian and International Good Roads Congress

Under the auspices of the Dominion Good Roads Association, the fourth annual Canadian and International Good Roads Congress will be held at the Horticultural Building, Lansdowne Park, Ottawa, Ont., from April 10 to 14, inclusive. More provinces and states will be represented on the coming program than were represented at any of the three previous congresses. This will insure a comprehensive consideration of road methods and materials from the standpoints of climate, geology, traffic and other local factors.

Cabinet ministers and officials from both Quebec and Ontario will attend the congress, among them being J. A. Tessier, Minister of Roads of Quebec; Walter Mitchell, Provincial Treasurer of Quebec, and F. G. Macdiarmid, Minister of Public Works of Ontario. The provincial road associations will also have delegates in attendance.

The exhibition of road making machinery is expected to be the most complete yet assembled in Canada, according to reports, emphasis being placed upon the labor saving possibilities of the newer inventions.

The morning sessions will be devoted almost entirely to the consideration of rural road problems, with an avoidance of technical terms. The afternoon sessions will deal largely with urban street methods.

Paul D. Sargent, Chief Engineer of the Maine State Highway Commission, will speak on modern methods of maintaining earth, clay and sand roads; Col. Wm. D. Sohier, Chairman of the Massachusetts Highway Commission, will deal with bituminous road surfaces; W. G. Yorston, Road Commissioner of Nova Scotia, will present the subject of "Highway Bridges and Culverts"; Geo. Hogarth, Chief Engineer, Ontario Highway Department, will read a paper on "Drainage and Foundations," and W. S. Huber, Engineer of the Ontario Highways Department, will talk on "Modern Road Machinery."

Among other speakers at the congress will be Wm. H. Connell, Chief of the Department of Public Works, Philadelphia, Pa., whose subject will be "Granite Block Pavements," and A. H. Blanchard, Professor of Highway Engineering, Columbia University, New York City, on "Road Oils." The eighteen papers scheduled for presentation include "The Highway in Relation to Town Development," by Thos. Adams, Town Planning Adviser, Commission of Conservation, Ottawa; "Safety on the Public Highways," by R. B. Morley, General Manager, Ontario Safety League; "Methods Employed for Making Road Material Surveys," by L. Reinecke, Geological Survey, Ottawa, and others of equal interest.

The annual dinner of the Dominion Good Roads Association will be given at the Chateau Laurier on Wednesday evening, April 11. Reports of committees and elections of officers will take place on Saturday, April 14. Other special features of the congress will be a meeting of the association to consider the proposed Dominion charter, on Tuesday evening, the 10th; annual meeting of the Canadian Automobile Association at the Chateau Laurier, Thursday evening, the 12th, and annual meeting of the Ottawa Valley Motor Car Association, Friday evening, the 13th.

PERSONAL NOTES

Christopher Harrison has been appointed City Engineer of Montclair, N. J. He was City Engineer, of Everett, Mass., for a number of years.

J. C. Hiteshew has been appointed Borough Engineer and Commissioner of Streets of Waynesboro, Pa. He was formerly City Engineer of Carlisle, Pa.

A. L. Strong, formerly County Engineer of Skagit County, Washington, is now on the engineering staff of the Skagit Valley Construction Co., of Mount Vernon, Wash.

S. Camden Miller, of the Canton Bridge Co., of Canton, Ohio has become associated with Mesker Brothers Iron Co., of St. Louis Mo., in the capacity of General Manager.

J. A. Mackall, formerly Engineer of Surveys, Maryland State Roads Commission, has been made assistant to Chief Engineer W. D. Uhler, of the Pennsylvania State Highway Department.

Howard F. Weiss, who has been director of the U. S. Forest Products Laboratory at Madison, Wis., has resigned and become associated with the C. F. Burgess Chemical Engineering Laboratories of that city.

Ferdinand W. Roebling, who died in Trenton, N. J., on March 16, was the son of the founder of the construction firm of J. A. Roebling's Sons & Co., noted bridge builders. Among the structures built by this company is Brooklyn Bridge, New York. Mr. Roebling was graduated at the Polytechnic College, Philadelphia, Pa., and was a member of the Union League and the Engineers' Club.

R. S. Woodruff has been made President of the Paving Commission of New Haven, Conn.

P. W. Loonan has been appointed County Highway Engineer of St. Charles County, Missouri, succeeding Alfred Riske.

Gen. George W. Goethals, the builder of the Panama Canal, has accepted the post of State Engineer of New Jersey, which was created by a special act of the legislature. Reference to legislation to permit the employment of Gen. Goethals as a general consulting engineer on the state's engineering projects was made in a previous issue.

LETTERS TO THE EDITOR

Enlightenment on Bridge Building

Editor "Good Roads:"

It was with considerable interest that I read your editorial concerning "Amateur Bridge Building" ("Good Roads," March 10, 1917, p. 167).

In Kentucky we are endeavoring to impress all that both road building and bridge building are engineering jobs. Editorials along this line may save countless hundreds of dollars from failures, by enlightening the people, and they certainly help the engineer.

CHARLES D. SNEAD,
Bridge Engineer,
Kentucky Department
of Public Roads.
Frankfort, Ky.

Concrete Road Costs in Connecticut

Editor "Good Roads:"

Having responded to the request of the New Jersey Commission on Road Legislation for suggestions regarding the financing, construction and maintenance of roads, under the general title of "Road and Pavement Economics," Dec. 22, 1916, in which the subject of Portland cement concrete roads was considered, I read with interest, in your issue of Feb. 24, 1917, your timely editorial and the letter on "Maintenance Costs of Portland Cement Concrete Roads"; also the article on "Maintenance of Concrete Roads in Connecticut," in the issue of March 3, 1917. These articles confirm the suggestion in my New Jersey report that Portland cement roads are not permanent, but need constant maintenance at greatly increased expense as the roads grow older.

The increased cost of first construction of Connecticut concrete roads, which you published for the first time, gives important information, being stated as follows: "In 1914 the cost varied from $1.10 to $1.35 per sq. yd., while the last contract awarded in 1916 was for $1.80 per sq. yd. Estimates for 1917 are based on an anticipated cost of about $2 per sq. yd."

The increase from 1914 to 1917 is, therefore, from 65 ct. to 90 ct. or from 48% to 81% per sq. yd. While it is undoubtedly in part due to the slightly increased cost of crushed stone, sand and labor, I believe it is principally due to the large increase in price charged for Portland cement at uniform rates in various zones or sections of the United States. The future cost of maintenance and eventual, necessary renewals will likewise be greater than heretofore anticipated. States, counties and contractors for Portland cement concrete roads must be careful to make their estimates high enough to cover the evident increased cost of construction and maintenance and be sure not to be misled by statements emanating from Portland cement manufacturers urging the use of their product for roads having surfaces of Portland cement; especially statements as to low annual maintenance when experience over a reasonably long period of years shows to the contrary.

J. W. HOWARD, C. E.
Consulting Engineer on Construction and
Testing; Roads, Streets, Pavements.
New York, N. Y.

Warren Patent Decision

Editor "Good Roads:"

A suit entitled "Warren Brothers Company vs. W. C. Evans," for the threatened infringement of the Warren basic patent, under which the bitulithic pavement is laid, was recently before the Circuit Court of Appeals for the Fourth Circuit sitting in Philadelphia, Pa., wherein both the validity of the patent was attacked, and its threatened infringement denied.

Judge Buffington, in delivering the opinion of the Court, stated: "This patent has been considered by the various federal courts and its validity established," and also: "The present case turns on the question of infringement."

The specifications under which the contract in suit was awarded, which it was claimed would necessarily require the construction of a pavement infringing the claims of the Warren basic patent, provided for the use of "bitumen"; "limestone dust or Portland cement"; "stone, ¾-in., hard, crushed"; and "sand, coarse to fine."

The Court held that under these specifications the contractor was called upon to use stone of one grade only, viz., ¾-in. stone, "which was not the run of the crusher," and that this was not the composition called for by the specifications and claims of the Warren patent.

After considering the several claims of the patent sued upon, all of which require the use of a graded mineral aggregate, and after referring to the several cases of Warren Brothers Company vs. Owosso, 166 Fed. Rep. 309; Warren Brothers Company vs. New York, 187 Fed. Rep. 831; and Warren Brothers Company vs. Grand Rapids, 216 Fed. Rep. 231, in all of which cases the validity of the patent in suit was sustained and injunctions issued to restrain its threatened infringement where the pavement had not already been laid before suit was commenced, the Court pointed out that in the New York case the mineral aggregate "was the resultant run of the crusher, which would necessarily have smaller grades of stone." The Court summarized its conclusion by saying: "It will thus be seen that in all these cases there was a series of graded stones. In the present case there is but a single grade of stone, namely, that which will pass through a ¾-in. mesh, and that which is caught on a ½-in. mesh."

As neither "run of the crusher" nor different sizes of stone were required to be used, the Court said there could be no infringement in this case, and the suit was accordingly dismissed.

This decision raises the following questions:

1. The practicability of actually furnishing a stone in large commercial quantities of the uniform size which the Court construes to be required by the specifications referred to, to wit: Stone all of which "passes through a ¾-in. mesh and that which is caught on a ½-in. mesh." Certainly no such finely screened, uniformly sized product has ever been furnished by any crushing plant operating along commercial lines. Furthermore, stone about 1-in. size, that is, passing a 1¼-in. screen and retained on ordinary dust jackets in the crusher plant, is the size of stone most generally

in demand for most purposes such as building construction, sidewalks, etc. The use exclusively of the intermediate portion ("which will pass a ¾-in. mesh and that which is caught on a ½-in. mesh," as defined by the court to be "¾-in. stone") of this ordinary crusher product in the quantities required for the wearing surface of a street pavement would evidently very greatly increase the cost of stone, and doubtless most stone producers would not agree to furnish stone of this limited size.

More particularly, approximately 50% of the ordinary stone crusher product is of 1-in. and finer sizes. Of this total of 50% finer than 1-in., approximately 50%, that is 25% of the entire crusher product, is coarser than ¼-in. size. Of this 25% only 40% or a total of 10% of the product of the crusher is of the uniform size which the Court in this case decides is described by the specifications in suit, to wit: that which "will pass a ¾-in. mesh and that which is retained on a ½-in. mesh." In other words, to comply with such specifications a contractor can use only 10% of the product of his crusher or from the crusher from which he purchases his supply, and other disposition must be made of the other 90%. For instance, given a paving contract to be laid at the rate of 1,000 sq. yd., requiring 75 cu. yd. of crushed stone per day, and a crusher plant having a rated capacity of 150 cu. yd. per day, that crusher would only furnish 15 cu. yd. per day or one-fifth of the daily requirements of stone for such a paving contract. In other words, it would take five such crushing plants to keep the paving plant in operation, and the person supplying the stone would have to find another market for 90% of the product of his crushers. Aside from this, the production of such a stone would require additional intermediate separating screen and bin facilities, which are not commercially used, and which could be installed only at great expense and inconvenience. In other words, the Court has excluded from the scope of the patent in suit the use of a stone which has never been practically produced, and cannot be produced without such increased expense and inconvenience that at least most owners of crushing plants would not undertake to do so, and then, under that extreme construction of the specifications, says that Warren's basic patent, No. 727,505, would not be infringed.

2. It is a self-evident fact that neither as high degree of stability nor freedom from voids can be produced by a mineral aggregate consisting of such a uniform sized stone and sand as is produced by the construction generally adopted, in which various sizes of crushed stone or gravel, sand and pulverized stone are used in such definite proportions as will produce the highest degree of stability, freedom from voids and utility.

3. Even though such a construction, using uniform sized stone (passing ¾-in. and retained on ½-in. screen) and sand be held to come outside of the Warren basic patent No. 727,505, it is very clearly directly in the teeth of the Warren patent No. 695,421, the single, very clear claim of which is as follows:

> A wearing layer of a street sheet pavement composed of a dense mineral body consisting only of relatively large elements, ½ in. and upward in diameter, and relatively small elements, one-tenth of an inch in diameter and less, having predetermined proportions and intimately and uniformly associated throughout the body to eliminate voids, provide stability and a wearing surface and a uniting weather proof, bituminous vehicle intimately associated with all the mineral elements serving to combine and unite them, fill the voids remaining unfilled and to form with the mineral body a solid, stable, homogeneous, tenacious, elastic, bituminous wearing layer.

As far as we know this patent, No. 695,421, has never been infringed in any actual construction.

Very truly yours,
WARREN BROTHERS COMPANY.
Boston, Mass. By Geo. C. Warren, President.

Illustration of New Jersey Road Wrongly Labeled

Editor "Good Roads:"

On page 173 of "Good Roads" issue of March 17, 1917, we notice a photograph of a road which you describe as a section of a new concrete pavement laid between Scotch Plains and Mountainside, Union County, New Jersey.

The photograph is really a section of grouted granite pavement laid by our company in the year 1915 on the Paterson and Hamburg Turnpike, between Paterson and Pompton Lakes in Passaic County, New Jersey. This work was done under state aid for Passaic County, and it seems to us that as the picture is used publicly, due credit should be given to the county and the contractor.

THE OSBORNE & MARSELLIS COMPANY.
By Arthur S. Marsellis,
Vice President.

Upper Montclair, N. J.

[Upon investigating we have found that the mistake referred to by Mr. Marsellis was caused by a film wrongly numbered. The illustrations in the article, "State Road Work in New Jersey During the Past Year," were made from a set of films received the day before the issue of March 17 went to press. The film from which the illustration in question was made was numbered 8, and opposite this number in the letter accompanying the film was a statement that the picture showed a "concrete road in Union County between Scotch Plains and Mountainside." The other information printed under the illustration in "Good Roads" was also included. We regret this error which was unavoidable, and gladly give space for its correction.—Ed.]

NEWS NOTES

More Than $10,000,000 Has Been Raised in Texas in campaigns for road bond issues, according to advices received from the state.

The State Attorney General of Texas has approved a bond issue of $150,000, the proceeds of which will be used for the construction of roads in district No. 9 of Navarro County.

Seventeen Miles of New Roads in Westmoreland County, Pennsylvania, forming connecting links in a system of improved highways, will be constructed during the spring, according to recent advices.

Thirty Miles of Modern Roads in Lincoln District, Marion County, West Virginia, will be constructed with the proceeds of the district bond issue of $650,000, which passed recently by a vote of 670 to 347.

Permanent Road Improvement in Cherokee County, South Carolina, will go forward under a bond issue of $225,000, the result of a vigorous campaign by the Gaffney Chamber of Commerce and interested citizens.

The County of Snohomish, Washington, will receive approximately $60,000 of state aid money. It is stated that the amount will be applied to the construction of a new bridge at Silvana and a new road between that point and Standwood.

The Road Bond Issue of $500,000 in Washington County, Wisconsin, will not be submitted to the voters of the county at the spring election. A special election during the summer has been decided upon, with an increase in the amount of proposed bonds to $1,000,000, according to a report.

The Legislature of Louisiana has passed a law creating a semi-annual road fund of $400,000 for a period of 41 years, beginning July 1. The money is to be loaned to the counties at 5 per cent. per annum for road improvement. A county desiring a loan must present a petition signed by 25 per cent. of its voters asking for an election, to be held on the second Tuesday in May, 1917.

GOOD ROADS

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Old Series, Vol. LI.
New Series, Vol. XIII.

NEW YORK, APRIL 7, 1917

Number 14

The Design of Steel Spans of Forty Feet and Over*

By CHARLES D. SNEAD†

During a period covering a number of years I have been connected with departments vitally interested in the proper design of drainage structures and it has been my good fortune to have been bridge engineer of such departments in two states. It is my desire to present to you some points of interest as well as of great importance in the design of steel bridges. Before doing so I wish to apologize to you for the repetition of well-known facts or at least seemingly so well known that doctors, lawyers, farmers, preachers, surveyors, some men styled as engineers, and loafers have without hesitancy criticised my work as too heavy, unnecessarily strong and too expensive. I am beginning to think the subject is so well known that a discussion of it may prove of little interest.

RESULT OF ERECTING BRIDGE OF TOO LIGHT CONSTRUCTION FOR THE TRAFFIC.

IMPROPERLY LOCATED BRIDGE—BOTH INCONVENIENT AND A SOURCE OF DANGER.

The design of a structure, be it steel or concrete, should clearly and unquestionably satisfy three conditions — durability, strength and ultimate economy. Durability without strength would be of little value in a bridge. Strength without durability would prove ultimately a waste of money rather than economy, as one might desire to explain the saving in first cost. Wooden bridges may be designed with strength equal to that of a steel structure, but ultimate economy will not be obtained by the employment of wood, due to the amount of lumber that must be used. A steel bridge may be designed to carry light traffic and cost much less than a structure which would be designed to carry a 15-ton tractor, but, due to its lack of strength, it would soon have to be replaced and plainly may we see the total lack of ultimate economy. If your state for a number of years had been building bridges and it was found that out of 33,000 bridges 23,000 were not capable of carrying a concentrated load of 5 tons, and many of them scarcely any load at all, could you believe that the erection of such bridges had proven economy and that the expenditure of money had been wisely made? Can you criticise a department which desires to look forward and anticipate such conditions? Ask yourself the personal question, How would you feel to know it would require 17 years, at the present tax rate, and $30,000,000 to replace work which could have been properly built at perhaps 30% increase in cost when first constructed?

There are many light, flimsy structures of steel spanning our creeks and rivers on important and unimportant highways. It appears to me that such structures have resulted from five causes: Firstly, lack of competent engineers; secondly, making appropriations for structures without accurate and reliable estimates; thirdly, the false economy of cheapening plans through ignorance; fourthly, the old method of receiving bids; and, lastly, the former policies of agents of bridge companies. Structural engineering is a specialty and few engineers not engaged in this line of work are capable of expressing opinions involving the theory and practice of this branch of engineering. Many have been the structures for which an appropriation has been made without a survey, plan or engineer's estimate; and many have been the plans which have been cut and skinned to meet the demand that the structure should be built within the allotted cost. No greater inducement for flimsy, weak structures could be offered a bridge company than to let it be known that the cheapest plan would be accepted as the design upon which bids were to be asked. It is true that engineers have often been requested to investigate the plans and report, but their ability as structural engineers is clearly denied by existing structures. Few officials would go to a horse trader and purchase a high-priced horse upon his recommendation alone, and yet the same officials have ofttimes reduced plans and built lighter structures upon the advice of the men selling the article and against the advice of engineers. Many have been the structures sold at enormous profit by men representing companies and interested solely in their profit and commissions. These structures could have been redesigned and built for approximately the same cost had a structural engineer been employed. It is to be noted that the better bridge companies today will not countenance such acts of their agents. The time has come when all taxpayers should demand that expenditures for bridges of all classes be made only for structures built under the supervision of structural engineers of known ability, and upon plans drawn by them.

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†Bridge Engineer, Kentucky Department of Public Roads.

A bond issue, a new town, the building of a railroad or some such development may cause an entire change in the designation of important and unimportant roads within the life of a bridge. One of the first bridges designed by another state was located at a small station miles from the county seat and in a locality where, to the people and the commissioners, the requirement that the bridge be designed for a 6-ton capacity seemed excessive. Scarcely one year elapsed before bonds were issued in this county. The bridge designed for 6 tons, after strengthening, was called upon to carry a 12-ton roller. I could cite other instances, giving names and dates. The increased live loads due to steam and motor tractors and their more general use tend to make all roads important in regard to the design of bridges. Agricultural tractors with shipping weights of 17½ tons, motor trucks with capacities of 10 tons, not including their own weights, and trailers capable of carrying loads of 15 tons, in addition to their own weights, are in use. In order that a bridge be designed to allow the passage of such loads and have the strength and durability to insure ultimate economy, I should recommend that all bridges with roadways of 18 ft. or less, except those contiguous to cities, be designed for a concentrated live load of 15 tons on two axles, 10 ft. centers, and 2/3 of the load on the rear axle, each axle having two wheels 6 ft. center to center, or a live load of 80 lb. per sq. ft. of roadway. In either event, 25% should be added for impact. In the design of the stringers I should recommend that the load be proportioned to three stringers. The stringer being investigated should be proportioned to carry the total load divided by 48, multiplied by the distance, center to center, of stringers, for wood floors. No distribution of the concentrated live load is considered in the direction of traffic. For concrete floors, it is my practice to proportion the load as follows for each stringer: The total load divided by 60 multiplied by the distance, center to center, of stringers. In the case of 4-in. wooden floors, the stringer spacing should not be greater than 27 in., and 3-in. and 2-in. flooring should not be used. Contiguous to cities, I believe we should design for a 20-ton tractor in addition to the uniform live load.

Due to the scarcity of and to the high cost of good lumber, concrete and treated timber floors are rapidly replacing the old types of wooden floors. A cushion of some description should at all times be employed on concrete floors, both to cushion the loads and to act as a wearing surface. Many requests have been presented for better types of floors in old trusses. In most instances we do not recommend such. A bridge, like a man, can carry just so much. We may overwork a man and he fails and breaks down; and just so surely in time will your bridges weaken, fail and break down if they are overloaded. Bridges, therefore, should be designed to carry a more permanent type of floor than the wooden floor now in general use. It must be plain to you that a bridge designed for 30 lb. per sq. ft. of roadway dead load is not as efficient under 73 lb. per sq. ft.

Be careful when some one recommends to you a large expenditure to strengthen a structure already 20 to 30 years old and explains to you how the continuous beam action and the heavy concrete floor will help your span. Remember the overworked man breaking down and remember the effect of overwork on your bridge. See if the man who advises you to make the expenditure doesn't get a commission out of the selling of the material, and remember that the sooner your bridge is a failure the sooner he can sell a new one.

Before going more into detail your attention is called to the substructures of your bridges. Many structures are failing today through the lack of proper design of abutments and many more through neglect or the lack of judgment concerning the foundations. This subject alone is of equal importance with the superstructure and should be thoroughly considered in a bridge design. In this discussion, however, I shall confine myself to the superstructure.

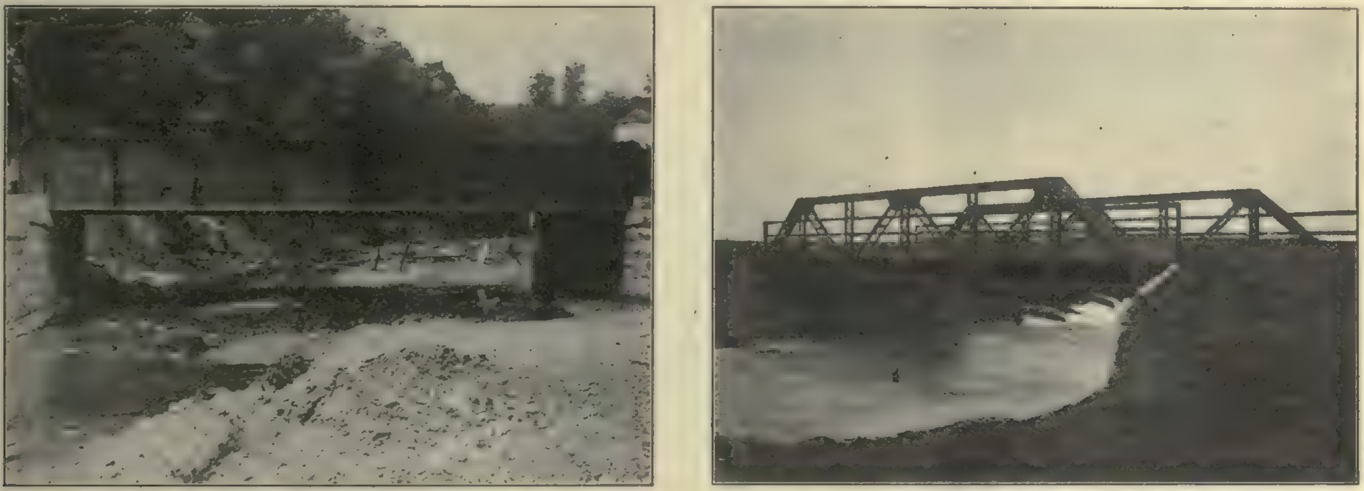
Bridge structures may be divided into two general classes —simple and higher structures. The simple structures involve such spans as the Warren, Pratt, Howe, Baltimore, Petit, etc., supported at each end, while the higher structures comprise arches, cantilevers, swing bridges, lift bridges, suspension bridges, etc. But few words need be said concerning the higher structures. We shall confine ourselves to draw-spans. Where a draw-span is to be operated without motors or similar machinery, it is my opinion that, in general, a draw-span built with a continuous truss and a center bearing will prove more efficient than the type using the rim bearing. Lift or bascule bridges are very efficient and satisfactory, however, from my personal experience. I have found that the swing bridge can be more cheaply installed than the ordinary lift or bascule bridge with the machinery required to operate it. A center bearing span is to be preferred for bridges with roadways up to 18 ft., rather than the rim-bearing, because it requires less power to turn, has a smaller number of moving parts, is less expensive to construct and maintain and is not dependent upon accurate construction of the center pier nor as much affected by any irregular settlement of the pier.

We shall now consider briefly the simple structures. Spans from 40 ft. to 80 ft. should be preferably plate girders or low riveted trusses, and from 80 ft. to 120 ft. through riveted trusses. From 120 ft. to 150 ft. either through pin or riveted trusses should be used, and beyond 150 ft., pin connected trusses. No attempt will be made to discuss the determination of stresses in the trusses nor the trusses which should be employed. Be careful in the design of a low truss to see that the top chord is thoroughly braced at the connection with the end post. Require that all trusses shall have an end floor beam, and that all floor beams are fixed against rotation. Eliminate the one-row rivet connection in the connection angles of floor beams to trusses and thus eliminate the eccentricity due to such a connection. See that top chord sections are figured efficient at least 90% considering eccentricity and bending due to their own weight, and that rivets are placed symmetrically about the neutral axis of the member. See that wind stresses, and both direct and bending stresses have been provided for in all end posts of spans longer than 150 ft.

In figuring wind stresses, I should recommend that we assume 30 lb. per sq. ft. of exposed area (twice the area of all portions of the truss except floor stringers) as a dead load on both the loaded and unloaded chord, and in addition thereto a live load of 100 lb. per lin. ft. on a loaded chord. The life of a structure may be sacrificed by a poorly designed lateral system, which should not only take care of wind stress, but also harmful vibrations.

There are piled, loop and die-forged eye-bars on the market which are used for tension members in pin connected trusses. The loop and piled bars may or may not be annealed. If not annealed internal stresses exist. Tests seem to show that none of the welded bars are as efficient as the die-forged bars. No packed, piled or loop bar should be employed in a bridge design—they double the chance of failure that is offered by the die-forged bar.

In riveted trusses special attention should be paid to the net section of members. There are several rules for determining the net section. One rule I have found most useful is the one employed by the New York Central Railroad and is as follows: Pass a plane perpendicular to the axis of the member through the largest number of holes possible. Deduct one hole for each of the holes thus cut by the plane and in addition thereto deduct the proportional part of all holes within 4 in. of such plane and lying on other gauge lines than the rivets cut by the plane, the part to be deducted being determined by the formula $A(1 - \frac{p}{4})$; where "A" equals area of one hole and "p" equals distance in inches of the hole from the plane. In general this will produce satisfactory results.



A 60-ft. Plate Girder in Pennsylvania.

A 50-ft. Steel Truss in Iowa.

TWO EXAMPLES OF WELL-BUILT BRIDGES OF PROPER TYPES.

No bridge is stronger than its weakest member. No plates less than ¼ in., no channel with web less than 0.21 in. in thickness, and no rod or bar of a section less than ¾ sq. in. should be used. Upset rods, upset 17% greater than the body of the bar, should always be employed. By eliminating our minimum sections we may for the time being not eliminate the strength, but sooner or later our structure will fulfill none of the three original requirements, as a result of the rusting of the thin sections and the racking of the structure by harmful vibrations.

Structures composed of several duplicate spans are often more economical than one span. The arrangement of spans should be decided only after a careful estimate of the cost of the substructure and a careful consideration of the action of piers in the stream. Hasty decision may spell failure.

No matter how careful the design, its final execution will govern its efficiency. Too much cannot be said concerning lax inspection and the elimination of shop inspection. We are too prone to try to get something for nothing and too prone to eliminate small costs and thereby risk the efficiency of the structure. The cost of adequate and complete inspection is more than paid for in the better workmanship and the increased life of the structure resulting therefrom.

The state department desires to aid the counties in their bridge work and see that the bridges are built with sufficient strength. No persuasion or pressure can swerve the department from recommendations which will mean an ultimate saving to the county. If, in the future, Kentucky be shown with 70% of her main bridges limiting the traffic on her roads, we hope to be in a position to say by whom such work was ordered and to prove that such work was ordered contrary to the engineering advice given by the department. Of the engineers who pass on such matters we ask help and cooperation. We ask that you remember that some day time may turn back and point to your decisions either with approval or else as a wilful waste and squandering of the people's money. We must depend upon you to enlighten the people and see that the same common sense is used in the erection and design of bridges as in a horse trade, that an engineer, and not a merchant or his agent, dictates the kind of bridge to be employed; that a structural engineer trained and experienced in such matters be consulted, not a surveyor; and, finally, that every dollar spent for bridges shall be spent upon designs which are to be recommended for strength, for durability and for ultimate economy.

Tennessee Counties Considering Large Road Bond Issues

In addition to the large bond issues which have been passed in several counties of Tennessee, other counties have been authorized to hold elections for submitting this phase of road improvement to the people. Among the latter are Campbell County, $100,000; Fayette, $200,000; McMinn, $300,000.

Overton County will vote for $200,000 on April 21, for roads and bridges, and Washington County will hold an election on April 17, to determine the question of a $500,000 issue in addition to that of $750,000 recently voted for macadam and asphalt macadam highways.

Cumberland and Humphries Counties have been authorized to issue road bonds in amounts of $200,000 and $100,000, respectively.

An Election is Being Planned for Orange County, Texas, to give the voters of the county a chance to decide the question of a road bond issue of $500,000.

The Transportation of Materials*

By GEORGE HOGARTH†

In the construction of highways where a surface of a more or less permanent character is to be prepared, the moving of the construction materials to the site of the work deserves the closest attention of those in charge. This applies to sand-clay road construction and also to the building of gravel and macadam roads and to the laying of pavements of concrete or bituminous materials, since in each of these types of construction a great deal of hauling has to be done. For the gravel and macadam roads, gravel and crushed stone must be moved in fairly large quantities; for the bituminous pavements, crushed stone and bitumen are required, and for the concrete pavement sand, crushed stone and cement are essential.

In laying out the work of road building the sand or gravel pits or stone quarries from which the materials will be secured are probably located so that wagons can be loaded at the plant and despatched directly to the road. At times material may be secured from distant sources of supply and this will require that the railways deliver the cars at stations convenient to the road. A proper selection of unloading points will facilitate construction, and due regard should be given to the choice of roads leading away from the railway stations in order that serious damage to the surface of such roads may be avoided.

An important point in the handling of all materials is to see that the loading and unloading of all wagons is carried out with the least possible delay. At the loading end bins may be made use of, since by that means a wagon is easily and rapidly loaded. This avoids delays to the teams, and a better showing will be made in the daily tonnage hauled. The manner of unloading the wagons also calls for some care and the type of box used will to a great extent determine what can be done at that end of the work. There are two types of wagons used for hauling, the slat-bottom wagon and the bottom dump wagon. The bottom dump wagon seems to be in general use today, as it has been shown to be the handiest for quick unloading.

Where materials are moved by power, as on industrial railways or with tractors or motor trucks, it is necessary that well equipped yards be provided to facilitate rapid loading and handling. Large storage bins will be required so that on the arrival of empty wagons an ample quantity of material can be quickly loaded by gravity. If bins cannot be provided, mechanical means should be obtained for loading and a crane installed. A large saving can usually be effected by careful attention to the quick loading of the wagons.

No matter how small or how large the work in hand may be, the superintendent should endeavor to keep an accurate check on the work done in order to arrive at the cost of the hauling. Cost data are very useful in preparing estimates and in comparing the work of different gangs or outfits, and every opportunity should be taken to arrive at the cost of the various parts of the work. Each superintendent will probably find that his charges for doing the same kind of work will vary from those of his neighbor doing exactly the same work, and the investigation pursued in finding out the reason for any large differences will usually result in certain reforms or betterments being made. By all means keep cost data, as it is the only way in which the work can be proved to be efficient.

For the greater percentage of road construction to be carried on for some years, there is no doubt that we must depend upon teams for the hauling of all material. Teams furnish a slow method of transportation and have a number of advantages and disadvantages. In some cases it might be found advisable for the county to own a few teams in order to set the working pace and always have teams available when wanted. When purchasing a team buy only the best horses; and see that they are properly looked after. While a county may own a few teams it is usually advisable, for economic reasons, to hire locally whatever other teams may be required. That is one advantage of teams—they can be obtained almost everywhere in sufficient numbers to do almost any ordinary job, and where a job is of small proportions it can be done most economically with teams hired at the site. Teams do their best work during summer when the temperature is moderate and when the roads are dry and in good condition for hauling. When hot weather arrives, teams will be found to slow down in pace and to tire more readily so that rest periods must be provided. That is a disadvantage possessed by teams and is a weakness to which mechanical transport is not subject.

The cost of hauling materials by teams will be affected by the state of the weather, by the kind of roads over which teaming is carried on, by the nature of the country, whether hilly or level, by the capacity of the team for work and by the rate per day paid for teams. In view of the number of important factors entering into the cost of hauling by teams it will be seen that costs may differ considerably in various parts of the country. On ordinary roads it will be found that a team will average about 20 mi. per day for round trips, or say 10 mi. per day with a load. Over easy grades a team should be able to move from 1½ to 2½ tons at a load or an average of say 2 tons hauled 10 mi. at a cost of $5.00 per day. The cost of hauling by teams is, therefore, on an average about 225 ct. per ton-mile.

Where a large system of roads is mapped out for construction and the building of those roads may extend over a term of years, the question of hauling by mechanical means should be examined into and an estimate of cost made of using such machinery. The types of mechanical haulage available today are: (1) road rollers; (2) steam tractors; (3) motor trucks, and (4) industrial railways. In estimating on using any of these means of hauling, several vital points enter into the calculations. One of the most essential details of the estimate is the first cost of the equipment. In order to arrive at the cost of moving the unit one ton, one mile—or the ton-mile as it is commonly known—it will be necessary to consider the annual cost of the equipment, which will be the total of the interest on the investment, depreciation per year, cost of repairs, operating charges, and the superintendence. The toal of that sum divided by the number of ton-miles hauled per annum will show the cost per ton-mile.

Road rollers are in some cases used for hauling, but because of slow speed they are not economical. However, in an emergency they may be of considerable use.

Steam tractors capable of hauling a train of five or six dump cars have been of use in road construction. The first cost of one outfit consisting of one tractor and five cars is about $3,700 and the annual charge is in the neighborhood of $4,100. In working 150 days per year the machine should move on an average about 30,000 tons one mile, so that the average cost of hauling by this means would be from say 7 to 10 ct. per ton-mile. These figures are based on 6% interest on investment, a depreciation of 15% per year, repair bills of 5% per annum, operating charges $6.75 per day and superintendence 5%. The steam tractor is usually easily kept in a good condition of repairs, is of simple construction with strong details, and may be operated by almost any intelligent mechanic. The figure of 7 to 10 ct. per ton-mile is calculated upon operating the engine for 150 days per year, and on any ordinary job it is possible to obtain efficient operation and costs as low as those quoted.

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†Chief Engineer, Ontario Department of Public Highways.

This low cost of hauling is made possible by the use of probably five or six trailers, each of which may have a capacity up to 4 cu. yd. or more. Such a train would be in charge of two men and 25 or 30 tons would be hauled per trip. On short hauls with good roads and no hills a very low rate for hauling by this means would be obtained.

Hauling by means of motor trucks has come into general use in the cities during the last few years and today nearly all tradespeople and warehouses deliver and transport their goods by motor truck. In view of the popularity enjoyed by the motor truck for this class of work, it is advisable that we look closely into its methods of operation and costs for building roads in the country.

One advantage enjoyed by the truck in the city is that everywhere good pavements are found and a low powered truck is able to move a large load satisfactorily under all weather conditions and practically for 300 days per year. Such pavements are ideal for truck operation.

It is well to point to this fact, and also, as a comparison, to call attention to the general state of country roads during spring, autumn and winter months of the year when impassable conditions exist. For hauling by truck in the country it is believed that 150 working days per year will be about the maximum in which truck operation is possible. The capacity of truck to purchase is important. Practically every size from 1 to 5 or 6 tons is manufactured and sold today. The heavier truck is at its best when operating over good roads, but for general hauling purposes the lighter truck will give better satisfaction, and experience indicates that the 3- or 3½-ton truck is the largest capacity that should be considered. The military authorities favor 1½-ton and 3-ton trucks, and these sizes have given satisfaction over what are described as horrible roads. Contractors on road work in the States claim that a 5-ton truck will usually spend a good deal of time extricating itself from ruts or broken bridges or culverts and, during wet weather, in pulling itself out of the ditch. They have had trouble with the heavy truck and today they believe the 3- or 3½-ton truck is the best to use. For one reason or another the heavy truck is frequently delayed on the road. Delays to such equipment decrease the efficiency greatly, as in order to get proper results a truck must be operated continuously.

In operating a truck on road construction it is often impossible to choose turning places and in some cases turns must be made in very close quarters. For that reason it is well to consider the wheel base of the truck being purchased. A long wheel base may prove awkward. With a truck having a wheel base of 124 in. it is possible to turn around on a 12-ft road with a sand shoulder.

In road construction one 3½-ton truck will usually replace six teams and with that information and some experience in the operation of trucks it is possible to estimate the cost of motor truck hauling. It will usually be found that on road construction the cost of tire renewals is fairly high and will amount to 5 or 5.5 ct. per mile of run.

An estimate of hauling by a 3-ton motor truck based on 150 days' operation per year is as follows:

Cost of truck, $6,000.00		
Annual Cost:		
Interest on investment, 6% on $6,000		$360.00
Depreciation per year, 20%		1,200.00
Repairs		200.00
Operating charges:		
Chauffeur, 6 months @ $80	$480.00	
Gas and oil, $4 per day	600.00	
Tires	375.00	
		$1,455.00
Superintendence, 5% of $3,215		160.75
Total		$3,375.75

In one season's operation under favorable conditions the truck will haul about 20,000 ton-miles at a cost of $3,375.75, or 17 ct. per ton-mile.

Such a truck may be good for a life of more than five years and in some cases ten years is the economical life of well built trucks, so that the cost per ton-mile for moving materials by motor truck will probably be from 12 to 15 ct. per ton-mile.

Narrow-gauge industrial railways have been used for years in the operation of coal mines and our steam railways of today are a compromise between the narrow and broad gauge of 50 years ago.

Industrial railways are adapted to the haulage of large quantities of material required in important undertakings and their use may be particularly advantageous for road purposes under certain conditions. Points in their favor are that they can run over soft ground wherever a track 2 ft. wide can be laid, they do not rut or tear up the road over which they operate and wet weather has little or no effect on them.

Light rails having a weight of about 20 lb. per yard are used and these are fastened to steel ties by bolts and clips so that two men can handle a section of track. The cars used are usually steel and of V shape, having a capacity of about two tons, and arranged so as to dump to either side of the track. The cars weigh about 1,000 lb. and, depending on the grades, 16 to 30 loaded cars may be hauled in a train. By this means 32 to 60 tons of material are moved to the destination at one trip, and at a speed of from 5 to 8 mi. per hour. As a long haul outfit the industrial railway is to be recommended, but the investment necessary to provide the equipment is many times the cost of any other method of hauling.

The outfit will usually require a length of track from 6 to 18 mi. and the total first cost of track, locomotives, cars and accessories will be anywhere from $35,000 to $60,000.

With such a large investment there is a heavy charge for interest and depreciation, while at the same time overhead expenses, operating expenses and incidentals may be heavy. The cost per ton-mile for moving material by this means may be anywhere from 17 to 25 ct.

Such a railway on a large work will frequently prove economical, but in order to do so, efficient operation is required and a heavy expenditure for yards and quick loading apparatus must be incurred.

Road Legislation in Tennessee

A bond issue of $3,000,000 by the State of Tennessee and a tax levy of one mill to provide $700,000 additional, are proposed for enabling that state to meet the terms of the federal aid road act. Measures providing for these two sources of revenue have been introduced in the 1917 legislature. The state's share of the federal funds is $1,400,000. In addition, the legislature has been asked to authorize the use of state convicts on state aid roads under the direction of the highway commission and the board of control, which body has direct charge of the penal institutions.

No general road law has been passed by the legislature and it is considered doubtful that one will be pushed at this session, owing to the fact that many bills applying to particular counties have been introduced. At the early part of the session a bill drawn up by a committee of citizens was presented. This provided for the creation of a county highway board in every county; the division of the state into twenty districts approximately equal in population, some being composed of a number of counties and others of a single county; a district highway board consisting of the county highway chairman and the secretary and engineer of the state highway commission; the election of a district engineer by the district board from a list of eligibles obtained by examination; the payment of the salary of the district engineer apportioned among the counties of the district according to their assessed valuation, and his field expenses by the county in which they were incurred; the building of all bridges and culverts of more than 10 ft. under plans furnished or approved by the state department.

The passage of this act has not been pressed, however, and the department will attempt to secure only such legislation as will enable it to secure federal aid.

A number of special bills has been presented. Several counties have placed a limitation of 5 tons on motor trucks, it being claimed that heavier loads have injured the roads.

Hamilton County, in which Chattanooga is situated, will be required to build permanent roads in the future under a bill for that county. The county highway commission is authorized to expend a sum not exceeding $50,000 on concrete bridges and culverts. At the end of the year the fiscal court is to issue bonds for the amount spent. In connection with this it has been reported by Superintendent Crox that during the Tennessee River flood every wooden bridge and culvert was damaged. The Harrison Pike Bridge, 150 ft. long, is the largest bridge washed out. The commission will do most of its road construction with asphalt and concrete.

A bill for Knox County, in which Knoxville is situated, provides for the election of a general road superintendent, who is to be a competent business man, a taxpayer and over 30 years old, and who will receive a salary of $3,600 a year. He is to have the services of an engineer, who is to receive $125 a month. In laying off district roads, the plans shall be approved by the justice of the peace.

Biennial Appropriations for Road Work in the State of Washington

Several acts relating to the improvement of highways have been passed by the Washington Legislature and signed by the Governor. They became effective on March 10. The laws are contained in Chapters 72 to 77 of the general statutes of the state, and are, in effect, as follows:

Chapter 72

This act provides a method for the collection and payment of the cost of improving certain highways by assessment of corporations, companies, persons and property particularly benefited by the improvement. Under this plan the benefits assessed against the county are one-half of the whole estimated cost of the work, against each road district or township, one-fourth, and against the lots and lands lying within the proposed improvement boundary, one-fourth.

Under the provisions of this chapter, the portion of the cost of the improvement chargeable to the improvement district may be paid for in annual installments by an annual tax levied upon the property assessed. The portions of the expense to be borne by the county, townships or road districts are levied and collected as other taxes, but the board of county commissioners, if requested by petition, may arrange that such portions of the expense may be paid in not to exceed five annual installments. Whenever the board of county commissioners shall have provided for the payment of the assessments in installments, if it seems necessary, it may issue bonds of the county, payable from the road improvement fund, not to exceed 20 years from the date of issuance, and at a rate of interest not greater than 6%. Should the improvement fund be insufficient to pay the interest or bonds when due, the amounts may be paid out of the general road and bridge fund or the current expense fund of the county. The law further provides that no assessments for road construction or improvements for which any county may be held liable shall exceed 4 mills in any one year.

Chapter 73

Section 1 of this act reappropriates the sum of $1,050,180.18, or as much thereof as may be necessary, from the permanent highway fund for completing work already under contract and construction on permanent highways, and for new construction and the maintenance of permanent highways. The above amount represents the unexpended balance of the permanent highway appropriations on Feb. 1, 1917.

Chapter 74

Section 1 appropriates the sum of $3,942,018.00, or as much thereof as may be necessary, from the permanent highway fund for completing work already under contract and construction on permanent highways, and for the purposes of new contracts on and the maintenance of permanent highways.

Chapter 75

This law provides for the engineering, construction and maintenance of primary and secondary highways of the state, by appropriating from the public highway fund the sum of $1,812,052, to be expended on roads as follows:

Pacific Highway, Chehalis to Vancouver	$248,878
Pacific Highway, Seattle to Olympia	57,350
Pacific Highway, Bellingham to Everett	134,125
Pacific Highway, Blaine to Ferndale	9,250
Olympic Highway, Thurston County line to Clallam County line	100,825
Olympic Highway, Mud Bay to Elma	53,187
Olympic Highway, Lake Quinault northwest	37,614
Olympic Highway, Forks south to Jefferson County line	27,750
McClellan Pass Highway, between Horse Shoe Bend and summit of Cascade Mountains	32,375
McClellan Pass Highway, between Enumclaw and summit of Cascade Mountains	69,375
National Park Highway, mountain road	92,500
National Park Highway, Nemah to Ocean Beach	46,250
National Park Highway, Riffe bridge	11,100
Inland Empire Highway, Benton City eastward	23,598
Sunset Highway, North Bend to Vantage Ferry	106,375
State Road No. 7, Blewett Pass	18,500
State Road No. 8, Skamania County line eastward in Klickitat County	15,000
State Road No. 8, between Prindle and Cook	40,500
Cascade Road, Skagit River opposite Marblemount in Skagit County, and extending up Cascade River	4,625
Skagit Highway, from Marblemount up Skagit River, 10½ mi.	4,625
State Road No. 10, Chelan to Okanogan County line	18,500
State Road No. 18, in Lewis County	9,250
State Road No. 21, Bremerton to Union City	46,250
Lake Chelan and Okanogan Highway	20,000
State Road No. 22, Myers Falls via Kettle Falls south.	10,000
Pend Oreille Highway, Newport and Mead	40,000
Sunset Highway, between Creston and Waterville	84,000
Vantage Ferry to Wilson Creek	80,000
Central Washington Highway, Sprague to Cheney	50,000
Central Washington Highway, Connell south	60,000
Inland Empire Highway, Oakesdale south	25,000
Inland Empire Highway, Pullman to Idaho line	25,000
Inland Empire Highway, Colfax north and south	45,000
Inland Empire Highway, Clayton toward Colville	20,000
Inland Empire Highway, Laurier south	30,000
Inland Empire Highway, Dayton north	40,000
Inland Empire Highway, Walla Walla west	40,000
State Road No. 4, Ferry County line west	15,000
Appropriations for completing state roads and securing federal aid on primary and secondary roads on east side of Columbia River up to its junction with line dividing Okanogan and Chelan Counties, thence following west line of Okanogan County to international boundary line	20,250

Chapter 76

This act assents to the provisions of the federal aid road law, directs the state highway commissioner and other officials to perform certain duties in connection therewith and provides for the apportionment of certain funds for carrying out the law.

The Citizens of Tulare County, California, recently approved a bond issue of $2,200,000 for the purpose of constructing a large mileage in that county, including the main trunk line from Dinuba on the north to Richgrove on the south by way of Exeter, Lindsay and Porterville.

Current Tax Levies for Road and Bridge Improvement in Minnesota aggregate more than $8,850,000, being largely in excess of the 1916 tax levied, according to a report. The amount does not include paving assessments, automobile licenses and similar revenues which, it is estimated, will bring the total to $10,000,000 for country road purposes.

The Arkansas-Louisiana Highway Improvement District in Arkansas will build 193 mi. of roads at a cost of $1,400,000. The work will be done under the supervision of the State Highway Department. Road Districts Nos. 1 and 2, in Lawrence County, will expend $100,000 and $200,000 on highway improvement, respectively.

GOOD ROADS

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New Series, Vol. XIII.

Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

APRIL 7, 1917.

THE DESIGN OF STEEL HIGHWAY BRIDGES

A few weeks ago we noted the collapse of a concrete bridge and took occasion to call attention in these columns to the necessity for the design and construction of bridge structures under the supervision of engineers if failures such as that described are to be avoided. What was said of concrete bridges applies also, in large measure, to steel structures, as was ably brought out in a lecture delivered by C. D. Snead, Bridge Engineer of the Kentucky Deparment of Public Roads, in the short course in highway engineering given at the University of Kentucky last February. The lecture is reproduced elsewhere in this issue, and is commended to those in charge of the building of bridges on roads and streets.

Structural engineering, of which steel bridge building is a very important branch, is rightly termed a specialty; and, as Mr. Snead further states, one relative to the technic of which few not actively engaged in it are capable of expressing opinions that deserve serious consideration. Yet many of the inadequate structures to which Mr. Snead referred were doubtless put up without any engineering worthy of the name. Many of them were bought "ready-made" of the agents of bridge companies, whose only object was to sell the most costly bridge that the purchaser could be induced to buy. As the sums available were usually small—too small to secure satisfactory strucures even with competent engineering—the bridges erected fell far short of the requirements. Moreover, there was seldom any check upon the bridge company and the structures secured were not even the best that might have been had for the money spent.

Fortunately, that method of selling steel bridges is fast disappearing. The irresponsible agent and his scarcely less irresponsible principal no longer operate extensively, and there is an increasing willingness on the part of those responsible to the taxpayers to employ engineers to attend to the buyer's end of the transaction. It is now possible to design a suitable bridge structure, award the contract for its fabrication and erection to any one of a considerable number of reliable bridge companies, and with ordinarily efficient inspection, be sure of getting a structure that will be what was called for.

But it is not advisable to attempt to dispense with the services of a competent engineer in designing and in supervising inspection. Each bridge, like each road, presents certain problems, and must be designed to fit local conditions. The word "design," as used here, does not necessarily imply the working out of every detail for each structure. Steel bridge construction has been so standardized that the work of design might often properly be described as selecting a suitable design. For instance many state highway departments have prepared standard plans for bridges of various spans and widths for different loadings. Even with this aid, however, competent engineering services are required to select the proper structure and perhaps modify the design in some particulars. The span and width of roadway are by no means the only factors that must be considered. As in the case of the road, due regard must be had for present traffic conditions and for those possible in the future. The erection of a bridge, in the same manner as the improvement of a road, may attract greater or greatly different traffic, and this, of course, must be provided for if the bridge is to best serve the purpose for which it is erected. These problems are distinctly engineering problems and should be treated as such.

One of the most important features in the design of a bridge structure is the design of the foundations. This point was merely touched upon by Mr. Snead. Improperly built abutments and piers have caused many bridge failures, and the proper investigation of conditions at the bridge site in order to insure the building of an adequate substructure demands the utilization of the best engineering services available.

Excellent work has been done by many state highway departments in the preparation of standard bridge plans which, with little or no modification, can be utilized by local engineers. An example of this is furnished by the standard plans for steel highway bridges of various spans issued by the Ontario Department of Public Highways which are noted on another page of this issue. Similar work has been done by the majority of the states in this country in which there are well organized highway departments. While these serve a very useful purpose, they should not be used except with the advice of a competent engineer, for the engineer's knowledge is required to make the proper selection and to make modifications if they are necessary.

NEWS NOTES

A Real Estate Dealer of Sacramento, Cal., declaring that it was necessary for him to drive all around the Sacramento Valley in order to reach his holdings at Nicolaus, whereas he ought to be able to reach his ranch in 45 min., offered to advance the amount necessary to construct a county bridge over the river at Nicolaus, according to recent advice from that state.

A Special Election Will be Held in Douglas County, Minnesota, during the coming summer in order that the taxpayers may decide the matter of a bond issue for good roads purposes amounting to $500,000. According to the report, it was believed by road officials that the question would be more favorably received at that time than at the regular spring election for which it was formerly scheduled.

The Chamber of Commerce of Athens, Ga., has provided an office for Geo. D. Marshall, of the Office of Public Roads and Rural Engineering, U. S. Department of Agriculture, who is in charge of the maintenance work on the roadway between Atlanta, Ga., and Columbia, S. C. Recent advices are to the effect that county officials along the road are cooperating in the work which is already under way over a considerable portion of the route.

State Highway Department for Indiana

The passage of the Dobyns-Duffy Road Act by Indiana legislators gives to the state a state highway commission to consist of four members appointed by the Governor. The law provides that not more than two members shall be of the same political party. After the first appointments, which shall be for one, two, three, and four years, respectively, the term of office is to be four years for each member. Each member will receive $600 a year and will be allowed his necessary traveling and other expenses in connection with his duties. The entire expenditures of the commission are limited to not more than $50,000 for office expenses and supervision.

The state highway commission is authorized to appoint a state highway engineer, either from within or without the state, who shall be "a competent civil engineer, experienced and skilled in highway and bridge construction and maintenance." His salary is to be fixed by the commission and approved by the governor, he is to serve during the pleasure of the commission and may be removed for cause by a majority vote. All employees appointed by him must be appointed for merit only and will be required to pass such examination as may be prescribed by the commission. "Any undue political party activity on the part of any employee," according to the law, will make him subject to removal.

The law requires the state highway commission to hold meetings at least once a month and oftener if necessary to carry out the provisions of the act. Roads to be designated as main market roads are to be determined by the commission.

The law provides that the state highway engineer shall have supervision of the construction and maintenance of all highways, bridges and culverts built with state aid money, which for any bridge shall not exceed $10,000, and shall, upon request, aid the county commissioners in establishing systems of drainage, and advise them as to the improvement and repair of roads and bridges on any highway. He shall conduct investigations and experiments regarding the best methods and the materials best adapted for road construction in the various parts of the state, and shall establish standards for the various counties with due regard to topography, natural conditions, character, location and availability of road building material, and for the purposes of the work may cooperate with the departments of geology at Purdue and Indiana Universities.

In order to avail themselves of state aid, it is provided that the boards of county commissioners shall make application to the state highway commission on or before March 15 of any year, and if the petition of any county is not received by that time, its apportionment of state aid money may be divided among the counties that have applied.

In order to carry out the provisions of the act a state highway fund is created which includes the proceeds of the inheritance tax paid into the state treasury on and after April 1, 1917, approximating $400,000, and appropriations of $100,000 from the state treasury on Sept. 30, 1917, and $500,000 from the state treasury on Sept. 30, 1918.

A county may issue bonds to pay for its part of the cost of state aid road construction or it may levy a special highway tax therefor as provided by law.

The main market highways of the state to be constructed shall not exceed 2,000 mi. by 1920.

The state highway engineer is required to make an annual report to the state highway commission, to be included in the annual report of the commission to the governor.

Under the Dobyns-Duffy Highway Commission law, as the act is commonly known, assent is given to the provisions of the federal aid road act and the good faith of the state is pledged to make available funds sufficient to meet the apportionments of government funds.

Paving in Nashville, Tennessee, During 1916

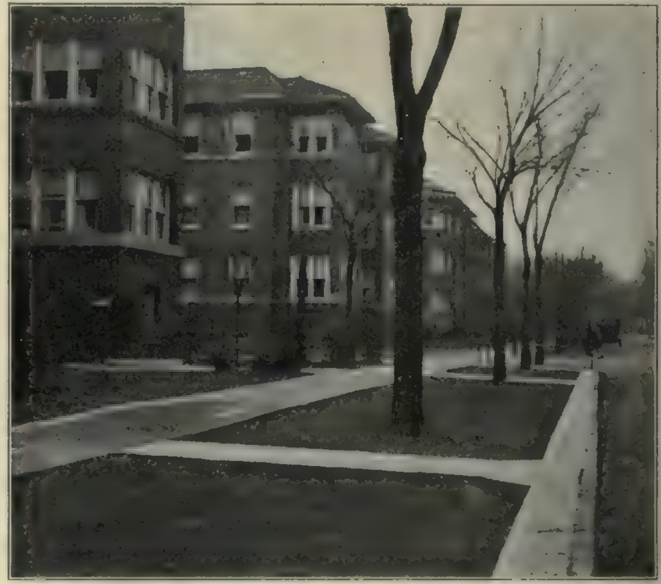
The annual report of W. W. Southgate, City Engineer of Nashville, Tenn., shows that during the year 1916, 17,420.70 sq. yd. of paving were laid by the city and property owners, and 39,606.85 sq. yd. by the railway company. The total cost to the city and the property owners was $331,693.62

The various materials used by the city were as follows: Bitulithic, 45,908.05 sq. yd.; Tarvia, penetration, 42,935.81 sq. yd.; Bitustone, 22,768.65 sq. yd.; asphalt, penetration, 22,494.85 sq. yd.; vitrified brick, 13,509.03 sq. yd.; granite block, 12,426.03 sq. yd.; wood block, 9,336.23 sq. yd.; concrete, 1,013.85 sq. yd.

Nashville has 342.27 mi. of streets, of which 164.73 mi. are improved. The average width of streets is 50 ft. Of all the improved area, 287,239 sq. yd. are bitulithic; 147,289 granite block; 146,289 vitrified brick, 110,854 wood block; 58,284 Tarvia macadam, and 41,257 asphalt macadam.

Auxiliary Walks on a Chicago Street

Partly as a convenience for people using automobiles and partly for the protection of the parking, auxiliary concrete walks have been laid on a residence street in Chicago, Ill.



AUXILIARY FOOTWALKS FOR AUTOMOBILISTS ON FARGO AVE., CHICAGO, ILL.

As may be seen by reference to the accompanying illustration, there is a narrow walk along the curb, with other narrow walks leading back to the sidewalk. The walks are about 12 in. wide and are built in the same manner as a sidewalk. The street shown is Fargo Avenue.

The City of Athens, Ala., will issue $135,000 in bonds to construct 135 miles of roads. A. P. Henderson is City Engineer.

A Concrete Road from Morado to Koppel, Pa., a distance of 4½ mi., will be built at a cost of about $90,000, according to a report.

Late Estimates by the Secretary of State of Iowa indicate that the state will have $1,150,000 for distribution to its ninety-nine counties for road construction. The amount is derived from the sale of automobile licenses.

The Widening of East 59th St., Between Second and Fifth Aves., New York City, was recently decided upon by the Board of Estimate and Apportionment. The present roadway which is 30 ft. wide, will be made 34 ft. wide and centrally located. The width of the sidewalks will be reduced from 15 ft. to 13 ft. Notice has been served upon property owners that all encroachments extending beyond the specified width must be removed on or before May 31. It is expected that this improvement will relieve traffic congestion due to the location of large factories near the eastern end of Queensboro Bridge.

MEETINGS

Calendar of Coming Meetings

April 10-14—Dominion Good Roads Association—Fourth Canadian and International Good Roads Congress, Horticultural Building, Ottawa, Ont., Can. Secretary, Geo. A. McNamee, 909 New Birks Building, Montreal, P. Q.

April 16-18.—Portland Cement Association—Spring Convention, San Francisco, Cal. Secretary, F. L. Page, 111 West Washington St., Chicago, Ill.

April 17-20.—U. S. Good Roads Association—Fifth annual convention, Birmingham, Ala. Secretary, J. A. Rountree, 1021 Brown Marx Building, Birmingham, Ala.

May 7-9.—National Conference on City Planning—Annual Conference, Kansas City, Mo. Secretary, Flavel Shurtleff, 19 Congress St., Boston, Mass.

May 23-24.—Michigan State Good Roads Association.—Annual meeting, Saginaw, Mich. Secretary, A. A. Anderson, Hastings, Mich.

June 11.—New York State Conference of Mayors and Other City Officials—Annual Conference, Buffalo, N. Y. Secretary, W. P. Capes, 25 Washington Ave., Albany, N. Y.

June 26-30.—American Society for Testing Materials—Annual meeting, Atlantic City, N. J. Secretary, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

Florida Good Roads Association

An interesting program is promised for the annual meeting of the Florida Good Roads Association to be held in Tallahassee, Fla., on April 11 and 12. Among the speakers will be George P. Coleman, State Highway Commissioner of Virginia, A. G. Batchelder, Secretary of the American Automobile Association, and many men identified with road affairs in Florida and elsewhere. Prof. Benton, Dean of the College of Engineering, University of Florida, will preside. Arrangements for the entertainment of members and visitors are in the hands of J. P. Clarkson, Secretary of the Florida State Road Department.

It is believed that the convention will indorse the plans of the Florida State Road Department to secure legislation relating to automobile licenses, empowering the department to establish a state road system and to make use of convict labor for a patrol system of maintenance.

Portland Cement Association

As noted in the issue of March 10, the spring meeting of the Portland Cement Association will be held at San Francisco, Cal., April 16 to 18, inclusive. The business sessions of the convention will be held at the Palace Hotel.

The programs for Monday, the 16th, and Tuesday morning, the 17th, will consist chiefly of the reading of reports of the various committees. There will be a general session of the association beginning at 2:00 p. m. Tuesday, for the discussion of problems relating to cement manufacture and mill practice. The board of directors meeting will be held at 7.00 p. m. at the Bohemian Club, and will be followed by a dinner and entertainment at the Cliff House for all members of the association.

The regular business session will begin at 10:00 a. m. Wednesday, the 18th, President B. F. Affleck presiding, at which reports of officers and committees will be received. An address on "California's Concrete Highway System" will be made by Charles F. Stern, member of the California Highway Commission.

The formal dinner of the association will be given in the Gold Ball Room of the Palace Hotel at 6:30 Wednesday evening.

On Thursday, April 19, a trip by automobile will be made to Del Monte, Cal., leaving the Palace Hotel at 8:30 in the morning, and arriving at the Hotel Del Monte at 12:30 p. m. A golf tournament in which members of the association will participate will be played on the Del Monte course on Friday.

Pennsylvania Good Roads Association

At the organization meeting of the Pennsylvania Good Roads Association in Harrisburg, Pa., March 27, more than half of the counties in the state were represented. Officers were elected as follows: President, R. L. Munce, Washington; Vice Presidents, W. H. H. Davis, of Chester; I. Loveland, of Lackawanna, and I. J. Dresse, of Center; Treasurer, William Field Shay, of Northumberland.

Alabama Good Roads Association

At a recent meeting of the board of directors of the Alabama Good Roads Association, in Birmingham, Ala., it was decided to pledge the support of the association to candidates for state offices who would work for the enactment of laws permitting the use of convict labor on the public roads of the state; the use of automobile licenses and taxes for the maintenance of roads; and for changing the state constitution so that state bonds may be issued for road construction.

Officers were elected as follows: President, F. A. Gulledge, Verbena; Secretary, W. T. Brown, Ragland; Treasurer, Maj. J. B. Elliott, Birmingham.

Pacific Highway Association

A meeting of the Pacific Highway Association of North America is announced for April 10, in the Press Club Hall at Seattle, Wash.

The objects of the meeting are to consider the wisdom of asking Congress to provide for the building of a military highway along the Pacific Coast from British Columbia to Mexico, to appoint a committee to cooperate with the states interested in securing the completion of the present Pacific Highway at an early date, and to appoint a committee to cooperate with the proper officers of the national government in mapping and planning highways suitable for military purposes in California, Oregon and Washington. Invitations are extended to good roads associations and individuals who are in sympathy with the movement.

Annual county road meetings in the State of Vermont will be held during April at the following places and dates: Bennington, 10th; Rutland, 11th; Middlebury, 12th; Burlington, 13th; North Hero, 17th; St. Albans, 18th; Hyde Park, 19th; Montpelier, 20th; Guildhall, 24th; Chealsea, 26th.

A recent good roads rally at Hamlin, West Virginia, was attended by four hundred citizens of Lincoln County. The call for the meeting was issued by the newly organized board of trade, and it is reported that petitions for bond issues to take care of a definite road building plan will be circulated.

PUBLICATIONS

HIGHWAY BRIDGES, 1917. Appendix to the annual report to the Department of Public Highways of Ontario, Can. Paper, 6½x9½ in.; 26 pp. and covers; illustrated.

This publication comprises a report on highway bridges by Chief Engineer Hogarth of the Ontario Department of Public Highways. It includes, besides general information on bridge work in the province, matter explanatory of the specifications for steel and concrete bridges issued by the department and also supplements a series of general plans for steel and concrete bridges issued by the department for the guidance of municipal authorities. The illustrations consist of reproductions of photographs of bridges and culverts in the province. Some of these illustrations show failures of improperly built structures.

GENERAL PLANS FOR STEEL HIGHWAY BRIDGES. Issued by the Department of Public Highways of Ontario, Can. Paper, 24x10 in., 31 plates, and covers.

This comprises 31 plates showing working drawings for steel highway bridges, concrete abutments and concrete culverts. Plates 1 to 13, inclusive, show plans for steel highway bridges of from 20 to 120 ft. clear span, with 16-ft. roadways. Plates 14 to 26, inclusive, comprise plans for steel highway bridges of from 20 to 120 ft. with 18-ft. roadways. Plate 27 carries a standard stress sheet and details of beam connections. Plate 28 shows plans for concrete abutments from 10 to 28 ft. in height. Plate No. 29 carries general plans for flat slab reinforced concrete culverts and concrete end walls for pipe culverts. Plate No. 30 carries general plans for square box culverts of concrete, and plate No. 31 plans for standard "U" abutments of concrete from 10 to 22 ft. in height.

PAVING ECONOMY; ROAD AND STREET. By Charles A. Mullen, Director, Paving Department, Milton Hersey Co., Montreal, P. Q. Paper, 5½x8½ in.; 98 pp. and covers; illustrated. Industrial and Educational Press, Montreal, P. Q. $1.00.

This book, as its title implies, is a treatise on the financial side of road and street work with especial reference to pavements. The illustrations consist principally of charts and drawings. The author was formerly in the contracting business in New York City, later Paving Expert and Superintendent of Street Construction and Repair in Milwaukee, Wis., and after that Commissioner of Public Works at Schenectady, N. Y. After leaving Schenectady, he returned to New York City and followed contracting until last year, when he took charge of the paving department of the Milton Hersey Co. Mr. Mullen's book covers various features of road and street work except the actual details of construction.

MICHIGAN STATE HIGHWAY COMMISSIONER. Sixth biennial report for the two fiscal years ending June 30, 1916. Cloth, 6x9 in., 136 pp.; illustrated, insets.

This report is divided into two sections and three appendices and is profusely illustrated by half-tone reproductions of photographs and by reproductions of maps, plans and diagrams. Section 1 comprises the general report of the State Highway Commissioner and includes discussions of trunk line road work, the organization of the State Highway Department, the road laws of the state, the department's specifications, federal aid and various other phases of highway work in the state. Section 2 consists of tabular statements of expenditures and work done during the period covered by the report. In Appendix A are printed the department's specifications and instructions for the construction, maintenance and repair of state reward roads. In these are included specifications for clay-sand, gravel, macadam, and cement concrete roads. There are also full instructions for the making of surveys and plans for state reward roads, for the use of road plans and profiles, and for the making of applications for state reward. Appendix B comprises the text of the principal amendments to the highway laws by the 1915 legislature and also various important decisions of the attorney general. Appendix C consists of inset sheets of standard bridge and culvert plans. Most of the illustrations are full-page halftones showing improved roads and bridges.

PROVINCE OF SASKATCHEWAN, BOARD OF HIGHWAY COMMISSIONERS. Report on the Road Drag Competition, 1916. Paper, 6¾x10 in.; 22 pp.; illustrated.

Besides a detailed report of the fourth annual road drag competition held during the summer of 1916, there are included in this report descriptions of the roads for which prizes were awarded, and a general discussion of the use of the road drag. The illustrations include half-tone reproductions of photographs of the four roads for which prizes were awarded.

PERSONAL NOTES

H. R. Gerrard, of Alberni, B. C., has been appointed City Engineer of Duncan, Vancouver Island.

A. R. Taylor, of Findlay, has been appointed State Highway Commissioner of Ohio, succeeding Clinton Cowen.

R. L. Slocum has been appointed Assistant Superintendent of the Universal Portland Cement Co., at Universal, Pa.

S. Benson, of the Advisory Board of the Oregon State Highway Commission, has been made Chairman of the Commission.

M. J. O'Neill, of the engineering forces of the New York State Highway Commission, has been made Town Engineer of Easthampton, Mass.

J. T. Davis, of Windsor, Mo., has been made Assistant Engineer of the Missouri State Highway Commission. His salary is $2,500 a year.

L. D. Lea has resigned as City Engineer of Lead, S. D., and has been placed in charge of the Export Service Corporation, of Chicago, Ill.

J. Russell Ellis, of Columbia, Mo., has been appointed Assistant Engineer of the Missouri State Highway Commission, at a salary of $2,500 a year.

Alexander W. Graham, of Kansas City, has been appointed Chief Engineer of the new State Highway Commission of Missouri, with offices at Jefferson City. He will receive a salary of $5,000 a year.

J. W. Bailey, former City Engineer of Baker, Ore., has formed a partnership with F. D. Stanley to conduct a general engineering business, with offices in the Citizens' National Bank Building, Baker, Ore.

C. M. Dulaney, of Bristol, Tenn., has been selected as Engineer of the Johnson County Pike Commission, Mountain City, Tenn. Mr. Dulaney will have charge of the building of a large number of roads under a recent bond issue of $200,000.

Harry R. Campbell has been appointed Statistician of the Pennsylvania State Highway Department to succeed W. R. D. Hall, whose resignation was noted in a previous issue. Mr. Campbell, who assumed his duties on April 2, was formerly Clerk to the County Commisioners of Washington County.

EQUIPMENT — TRADE — MATERIALS

"Merriman" One-Car Asphalt Plant

With the growing use of asphaltic mixtures in the construction and resurfacing of roads and streets has come a demand for portable and semi-portable plants for drying, heating and mixing the materials. The result of this demand has been the development of plants of various types, ranging from the small outfits that can be taken out on the road to the larger plants that are taken from place to place by rail and operated on a convenient siding. One of the latter type, a "Merriman" one-car asphalt plant, is shown in the accompanying illustration.

This plant is built on a heavy steel frame, mounted on standard four-wheeled trucks. The plant proper comprises a boiler, drier, mixer, steam heated asphalt kettles, storage bins, screens, weighing boxes, elevators and the necessary driving and operating mechanism.

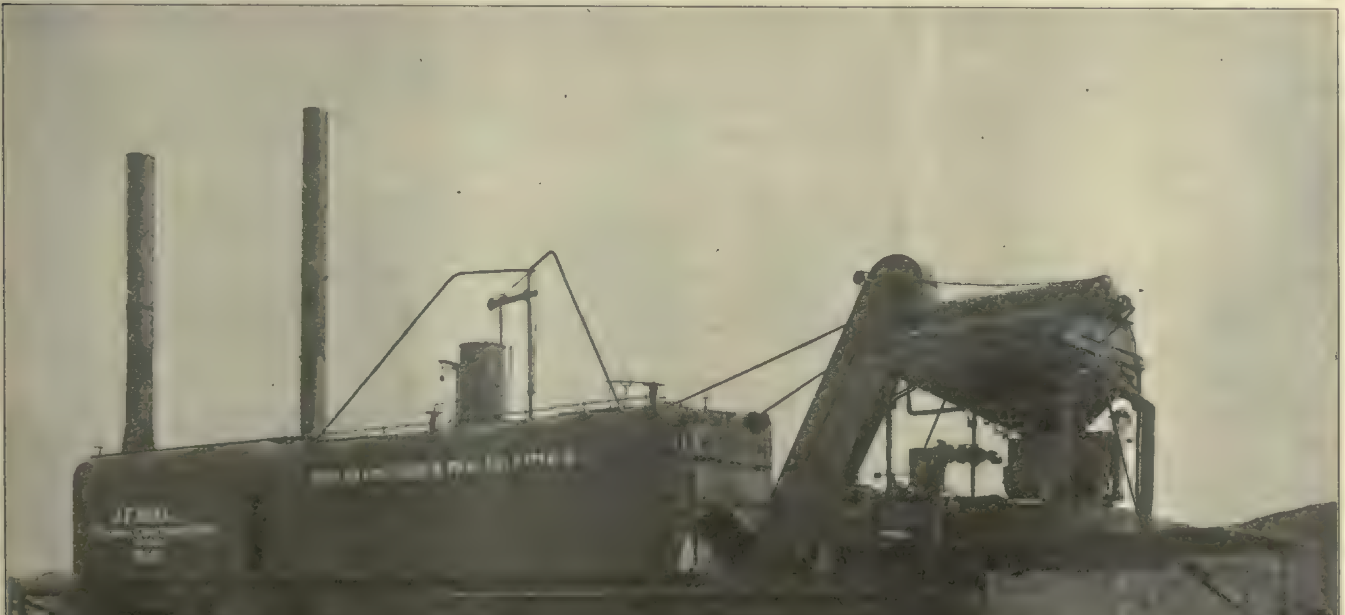
The frame is entirely of steel and is built of heavy I-beam sills reinforced with heavy truss rods and turnbuckles, with heavy I-beam and channel framing between the sills. There is an automatic coupler at each end and the car is provided with standard Westinghouse air brake equipment. The car construction complies fully with the M. C. B. and Interstate Commerce Commission standards. The plant ready for shipment is 9 ft. wide, 14 ft. high and 65 ft. long or 50 ft. long. When ready for operation the length is increased at one end 8 ft. 6 in. by the extension of the mixer platform and at the other end about 9 ft. by dropping the end of the cab to form a firing platform for the boiler. The height in operation is also increased by raising the stacks, the hoist and the storage bins.

The boiler is of the tubular marine type and has about 931 sq. ft. of heating surface. It is tested to a steam pressure of 150 lb. and a cold water pressure of 250 lb. It is inclosed by a steel cab which also houses the drum driving engine, the gearing for the cold stone and sand elevators and the air compressor supplying air for agitating the material in the kettles and forcing the melted material to the weighing box.

The drum of the drier is 28 ft. in length and 5 ft. in diameter and rotates on heavy shafts running in babbitted bearings supported on the main car frame. It is heavily reinforced by cast steel spiders and steel channels and the interior is equipped with spill plates to which are bolted spiral flights for conveying the material from the feed end to the discharge end. It is driven by a 15 hp. engine of the horizontal type and heated by a furnace suspended underneath. This furnace has 78 sq. ft. of grate surface and 5 fire doors which can be seen in the illustration, near the center of the plant. It is lined throughout with fire brick and the frame beams above are further protected by a dead air space formed by a steel plate decking and a wall of asbestos.

The cold stone and sand elevators are equippd with clutches so that either one or both may be thrown out of gear without interfering with the drum drive. These elevators are supported at the outer end on heavy portable wooden frames equipped with heavy devices to take the tension of the elevator chain. This chain is of the standard adjustable link type, carrying malleable iron buckets. The chain runs over face-wheels, which have been found to give better results than sprockets.

The melting kettle is divided into two separate compartments, each of which has its own set of steam coils, agitators, valves and manholes, this arrangement permittting hot material to be used from one compartment while the other is being charged. The melting of the material is



MERRIMAN ONE-CAR ASPHALT PLANT.

accomplished entirely by steam heat to obviate any chance of buring the asphalt. The kettle is placed over the drier, the bottom being saddle-shaped to fit over the upper part of the drum. This arched bottom is protected from direct heat from the furnace by a steel housing carrying a heavy coating of asbestos mortar. A false bottom on one side permits both compartments of the kettle to be drained into one leg of the saddle, from where it is discharged into the asphalt scale bucket at one end of the plant. The kettles are thoroughly stiffened with angle irons and tied with rods and turnbuckles. Arrangements for cleaning out are placed at the bottom of the long leg and also just above the false bottom, and the compartments are provided with safety valves to eliminate danger from excessive pressure. The two compartments of the kettle have a combined capacity of 1,265 cu. ft. when filled to within 8 in. of the top. Each kettle is supplied with about 1,088 lin. ft. of electrically welded pipe coils, to prevent leakage, the condensation from which drains to a reservoir, from which it is returned to the boiler by the feed pump. Each compartment is equipped with an agitator system, with the necessary valves to permit the use of either steam or air for agitation. A steam jacketed pipe line leads from the kettle to the asphalt weighing bucket.

The hot material storage bin regularly supplied with the plant has a capacity of about 3 cu. yd. This, however, is sometimes doubled on special order by increasing the height of the bin. Each bin is regularly supplied with three gates, and inclosed angles are placed at proper intervals on the inside of the bin to facilitate the placing of partitions if it is desired to separate the material into two or more sizes. Special bins containing a larger number of gates and partitions have also been supplied for special work.

The mixer is of the pug mill type, with opposed blades, mixing from one end to the center. Gates are placed in the bottom of the pits and are operated by conveniently placed levers. The mixer is driven by a direct connected 25 hp. horizontal engine. The hot material elevator for conveying the dried and heated aggregate from the discharge end of the drum to the hot material bin is driven by an independent 5 hp. horizontal engine.

The mixer, mixer engine, hot materials bin, asphalt weighing box, aggregate weighing box, the engine for driving the hot material elevator and the engine for operating the asphalt hoist are placed on the movable mixer platform. When the plant is ready for shipment this rests directly on the frame and is contained within the 65-ft. length. When the plant is set up for work, this platform is extended 8½ ft. by means of heavy screws running in babbitted nuts. The hot material bin is also raised to its working height by a similar device.

In operation, the cold aggregate is conveyed to the cold material elevator, by which it is discharged into the drum. It passes through the drum, which revolves at 8 r. p. m., the time required for the passage being about three minutes. From the discharge end of the drum it is conveyed by the hot materials elevator to the screens, which discharge into the bins, where it is held until drawn out through the gates in the bottom of the bin and discharged by gravity into the weighing box, which in turn discharges into the mixer. The material rejected by the screens passes into a separate hopper.

The barrels of cold asphalt are usually stripped and cut up, placed in tubs and weighed on the ground. The asphalt is then raised by a steam hoist and placed in the kettles through manholes in the top. The flux is pumped into the kettles by an oil pump, which is also part of the plant. After the kettles have been charged the covers are placed on the manholes and secured and the steam turned into the coils. When melted the asphalt is conveyed through the steam jacketed line to the asphalt weighing bucket, where the necessary amount is weighed out and discharged into the mixer. Dust is kept in storage on the mixer platform, and, if desired, a dust elevator is furnished, although this is not a part of the regular equipment. The mixer discharges directly into wagons, the mixer platform being high enough to permit them to be driven under it.

Among the special advantages claimed for this plant are the patented steam heated asphalt melting kettles; its substantial construction for reducing to a minimum the loss of time through breakdowns, and the steam jacketed asphalt pipes, which eliminate delays for thawing out pipes in cold weather. Another advantage to which the manufacturers call attention is the providing of separate power units for each of the principal working parts, by which the necessity for a complete shutdown in case of a break is obviated and different parts of the plant can be run independently.

The plant has a guaranteed capacity of 2,000 sq. yd. of 2-in. topping per 10-hour run, this guarantee being made by the manufacturers for unfavorable conditions. Many contractors now using these plants are said to have secured as high as 3,500 sq. yd. of 2-in. topping per 10-hour run under favorable conditions.

A smaller plant of the same design is guaranteed for a capacity of 1,200 sq. yds. of 2-in. topping per 10-hour run. This plant, it is said, has produced as high as 2,200 sq. yd. under favorable conditions.

The plants are manufactured by the East Iron & Machine Co., of Lima, Ohio.

Motor Trucks to Relieve Freight Congestion

The availability of motor trucks for long hauls was emphasized by S. M. Williams, Sales Manager of the Garford Motor Truck Co., at a recent gathering of motor truck dealers.

Mr. Williams is quoted as having declared his belief that the motor truck would eventually solve practically all freight congestion problems. He pointed out that the truck provided for the first time an efficient haulage system direct from the shipper to the buyer, thereby eliminating a considerable waste of time and subjecting the materials hauled to less handling than when moved by a railroad. "In every sense of the word, emergency haulage by motor truck has been successful," Mr. Williams said. "Given reasonably good roads on which to travel, there is no limit to the advantage of the motor truck for either intercity or interstate transportation."

The Acme Road Machinery Co., of Frankfort, N. Y., has recently issued an 8-page folder describing the "Tom Thumb" graders. The booklet, which is designated as Bulletin No. 100, is 9x6 in. in size and contains illustrated descriptions of the "Tom Thumb Senior" grader and the "Tom Thumb Junior" grader. Complete specifications of the models are included.

A profit sharing plan by which over 11,000 of the 12,500 employees of the company became stockholders has recently been put into effect by the Firestone Tire & Rubber Co., of Akron, Ohio. Approximately $3,000,000 in stock was distributed on the basis of length of service. By the arrangement made those who wished to do so were permitted to pay for the stock immediately, but provision was made for paying in instalments as low as $5.60 per month on a $1,000 purchase. The stock was sold to the employees at $100 per share, although at the time it was quoted at $145. The agreement made provides that the company shall hold the stock for five years, after which, if it is all paid for, the certificates of stock pass wholly into the hands of the employee, whether or not he remains in the employ of the company. The company is capitalized at $15,000,000.

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Important Details in Oiling and Tarring*

By W. HUBER†

It has been thoroughly demonstrated in recent years that roads carefully constructed of good crushed stone or gravel, on well-graded, well-drained subgrades and properly consolidated and bound, will not withstand the wear and tear of traffic as they formerly did. This fact is due not to any lowering of quality of material or standard of work, but to altered traffic conditions. The failure of ordinary stone and gravel roads under such new conditions has led many to believe that the usefulness of these materials for important rural road construction has ceased. But such is not the case. The failure has been traced to conditions in the road surface, not in the body. It has also been proved that with comparatively inexpensive treatment and maintenance of the surface, a well built stone or gravel road may be made capable of carrying any ordinary traffic without undue deterioration.

SWEEPING ROAD SURFACE PREPARATORY TO APPLYING BITUMINOUS MATERIAL.

The need of some form of surface treatment to prevent dust on the more heavily traveled roads and to protect them from the effects of present day traffic is now almost universally recognized, and the amount of protective work of this kind is increasing each year. The benefits of such work are twofold—first, in the prevention of excessive wear, and second, in the increased comfort of those using or living in the vicinity of the highway, through the elimination of dust, to say nothing of the prevention of damage to fruit and crops of all kinds growing near the road.

While in this province the treatment of roads with oil or tar has up to the present been restricted largely to city, town and village streets, and to roads in the immediate vicinity of large centers, there is reason to believe that the majority of the most important rural roads will soon be treated in the same way. Owing to lack of experience on the part of those doing the work, the results in many cases have not been satisfactory, and this fact is frequently construed as a reflection on the efficiency of surface treatment. While a lot of inferior material under the name of road oil has been used—and proved not only unsatisfactory but also injurious—it must be remembered that the very best material may fail to serve its purpose if applied under unsuitable conditions or in an improper manner. Good results in the application of oils or refined tars will depend entirely on the care with which the materials are selected and the several operations carried out. Of no other branch of highway work can it be more truthfully said that the keynote of success is careful attention to every detail, or that failure to observe every one of the many important points may be followed by failure of the treatment.

APPLYING BITUMINOUS MATERIAL TO A PREPARED ROAD SURFACE.

The first important point in connection with the application of oil or tar to a road surface is the choice of material. Good intentions are frequently frustrated and excellent prospects spoiled by the selection of a bituminous material unsuited to the work. There are numerous different conditions under which bituminous materials are used and there are several grades of material. Complete success depends on the selection of that grade of oil or tar which best suits the work in hand.

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The different materials used for the prevention of dust and for the preservation of the road surface have been classified as non-asphaltic oils, asphaltic oils and refined tars. If the material to be selected is expected to contribute in any degree to the binding of the road surface the choice will lie between asphaltic oils and the refined tars. The non-asphaltic oils may serve the purpose of dust layers, and, if applied with sufficient frequency, may do much to protect the surface, but their effects are at best only temporary and except for the protection which the road has received in the meantime, it is no better at the end of a period of treatment than at the beginning. Therefore the non-asphaltic oils must be considered only as dust preventives.

On the other hand, the asphaltic oils, i. e., those oils having as a base a certain amount of pure asphalt, are more than dust layers, and each application leaves, on the evaporation of its volatile constitutents, a certain amount of asphalt in the road surface to act as an aid to the binder. The greater the asphalt content in the original oil, provided it has been properly applied, the greater will be the permanent benefit derived from its application.

As between the true asphaltic oils and the refined tars of corresponding grades there appears to be little choice, excellent results having been observed from the careful application of either material. Satisfactory results would, therefore, appear to be due not so much to the choice between oil or tar as to the selection of the most suitable grade and to the methods of application.

The best results with any grade of material are obtained when the surface is absolutely clean and thoroughly bound. If the road surface does not comply with these requirements, the application of heavy oils or tars is not only a waste of money but may result in actual damage to the road by hastening rutting and raveling. It may be stated as an axiom that the cleaner and smoother and harder the road surface immediately prior to treatment the more complete will be the prevention of dust, the greater will be the protection to the surface and the longer will be the life of the treatment. The less any material is required to act as a dust preventive, the more it is enabled to act as a binder. If it is proposed to treat a road covered with dust, or only partially bound, then only a dust layer is required, and the use of a heavy oil or tar having other than dust laying qualities is not justified

Application of asphaltic oils or tars in any but the warmest weather is not recommended, but should it be found necessary to treat a road in the early spring or late fall when the body of the road is comparatively cold, only the lighter grades should be used.

Having decided on the grade of oil or tar best suited to existing conditions, the next important step is the selection of a suitable day for the application. The warmer the weather the greater will be the penetration of the bitumen into the stone, and the more satisfactory and permanent will be the result. The actual application should be made during the warmest part of the day, when the road itself has become heated. The longer the oil or tar can be kept in the liquid state the better grip it will have on the road, and the less danger of subsequent peeling off.

The first operation in the surface treatment of roads is the removal of all dust and foreign matter from the surface. Casual sweeping is not sufficient. The road must be swept till no dust remains, and the bare stone shows over the entire surface. A horse-drawn rotary sweeper, which may be purchased for about $300, will give the best results at the least cost. Whatever the means employed for cleaning the surface, it must be emphasized that dust between the body of the road and the oil or tar is decidedly objectionable and must not be permitted.

The lightest oils may be applied with an ordinary sprinkling wagon, but the best results follow the use of a pressure distributor. Being discharged under pressure, the oil strikes the road with a considerable velocity, which causes it to spread more thinly and evenly and assists penetration. For the heavier materials, the pressure distributor must be used.

The quantity in which the oil or tar is to be applied is one of the most important details in surface treatment. The exact quantity measured in gallons per square yard cannot be stated, as this will depend on a number of factors, chief of which are the grade and fluidity of the material used and the condition of the road surface. Sufficient should be applied to cover the entire surface, leaving no bare spots, but positively no more. Any in excess of the quantity mentioned will be more detrimental than beneficial, in addition to causing a direct waste of money. The lighter, and consequently the more fluid, the oil the thinner it can be applied and still cover the road. For the same grade of material the consumption will be proportional to the area covered. Therefore a smooth road, presenting less surface area than a rough one, will require less to cover it. A smooth surface also offers a better opportunity for even distribution and more uniform wear. An excess of material, particularly of the heavier grades, will run to the sides and cause lumps. Hot weather, assisted by the crown of the road, will eventually bring all excess to the edges in thick uneven lumps and waves which make travel on the sides of the stone very uncomfortable. Therefore, for the sake of appearance, of economy, and of comfort, the application should be carefully watched to see that absolutely no more oil is applied than is necessary.

Another important point is the temperature to which the oil or tar is heated. Some of the lighter oils may be applied in hot weather without heating, but better results have been obtained where even 40% oil has been heated, the principal advantage being better penetration. No definite temperature can be specified since different materials and different grades of the same material require different temperatures for the best results. The correct temperature for any given material may always be ascertained from the manufacturer, and this temperature should be strictly adhered to.

The oil or tar having been applied, it must be given a fair chance to obtain a grip on the road, for on the adhesion between the road and the new surface will depend the life of the treatment. If the application has been made on a warm day, on a properly cleaned road, there will be no difficulty in obtaining a satisfactory penetration and no danger of peeling or scaling. The surface should be left entirely undisturbed for half a day; 24 hours is better. Traffic must be kept off. This is imperative. Wheel tracks have frequently been seen on oiled or tarred roads shortly after treatment, due to the passage of vehicles over the surface before the oil or tar had properly penetrated, or before the sand or stone chips had been applied. If it is impossible to keep traffic off the road during the entire operation and for a reasonable time afterward, only half the width should be treated at one time, leaving the traffic free to use the other half.

After the oil or tar has been distributed over the road surface and allowed to penetrate to as great a degree as possible, it must be covered with some material which will take the wear of traffic. For it must ever be remembered that not one of these bituminous materials, from the lightest oil to the heaviest grade of tar or asphalt, whether in the body or on the surface of a road, is a wearing material; it is nothing more or less than a binder whose sole purpose is to hold together the separate particles of some hard substance capable of taking the wear. In the case of surface treatment this wearing material usually consists of sand, fine gravel or stone chips. The lighter the oil or tar, the finer will be the covering material which will be most suitable. For a light asphaltic oil, say 40 to 50%, fine sand will give a satisfactory surface; for a 60% oil, or tar of the grade known as Tarvia "B," coarser sand should be used. For 80% oil, or tar of the grade known as Tarvia "A," the material should be ½-in. to ¾-in. stone chips, or pea gravel. The two requisite qualities in any grade of covering material are toughness and cleanliness, and a slight extra expense should not stand in the way of securing materials with these absolutely necessary qualities. The best fine material is a clean, sharp quartz sand, water-washed, if possible. For the heavier applications trap chips, free from dust and dirt, are undoubtedly best, and their use is justified even at twice the price of pea gravel. Since the wear comes on the stone and not on the tar or oil, and since a cubic yard of covering material will cover from 75 to 150 sq. yd. of surface, the extra expense of securing the very best material, considering its superior merits, is negligible.

Where the heavier materials, such as 80% asphaltic oil or Tarvia "A" are used and covered with pea gravel or stone chips, a light roller should be used to finish the work. The rolling forces the stone into the bitumen, reduces the voids in the stone and increases the proportion of stone in the wearing surface. The carpet coat, as it stands when finished, constitutes a species of concrete in which the gravel or stone chips correspond to the coarse aggregate in ordinary concrete, and the tar or asphalt to the cement mortar. As in ordinary concrete, the smaller the voids in the coarse aggregate the more durable will be the concrete. The rolling reduces the voids in the stone, increasing the proportion of stone to bitumen, and a mixture is secured which is less susceptible to heat and which has not the same tendency to run or bleed in hot weather as is shown by a surface coat which does not contain sufficient stone. The success of the heavier carpet coat depends on the material remaining where it is placed, and this cannot be assured unless there is enough stone to prevent running and the consequent formation of waves and lumps. The rolling may be done immediately after the stone has been spread over the road, and should be repeated the following day when the road has become warm again. If "bleeding" occurs, i. e., if the oil or tar comes through the surface either during rolling or subsequently, it is an indication that more stone is required to take up the excess of bitumen. Two or three trips with the roller are sufficient for this operation, and best results are obtained from rolling in warm weather and during the warm part of the day. A light tandem roller, if such can be obtained, will accomplish the work more quickly at less cost of operation.

The success of any surface treatment depends absolutely on the maintenance of an unbroken surface. Experience and observation have shown that where an oil or tar surface has worn off, leaving the bare stone exposed, the road disintegrates more rapidly than an untreated road, and a pit soon forms. These pits, in large numbers, soon make a rough road, which is very uncomfortable to traffic. Constant care is the only safeguard against such a pitted surface, and to that end the road should be patrolled at short intervals and any bare spots, or spots which threaten to become bare, thoroughly cleaned and covered with the same materials as were originally used. If this precaution is observed, and if the road has been constructed on a well-drained subgrade and with sufficient body to support the weight of traffic passing over it, the body of the road should last indefinitely, requiring only periodic treatment to keep it in first-class condition.

Summing up, success in oiling and tarring roads will depend on many factors, principal of which are the original condition of the road, the care with which it is cleaned prior to treatment, the selection of the most suitable grade of material, the weather in which the work is done, the temperature to which the oil or tar is heated, the quantity in which it is applied, the protection from traffic of the freshly treated surface, the proper covering with suitable material to take the wear, and finally on the careful maintenance of the treated road. The fulfillment of these requirements demands no special technical knowledge, but it does demand extreme care in the preparation of the road surface, the selection and handling of the materials, and the maintenance of the road after treatment.

Road Legislation in Pennsylvania

Road laws passed by the Pennsylvania legislature to date have consisted of a bill amending the Sproul Act of 1911 and a resolution accepting the provisions of the federal aid road law.

The first act permits the use of state aid funds on state highway routes either in boroughs or in townships.

Paving in Sioux City, Iowa

The repaving of sixteen blocks of streets in Sioux City, Iowa, has been ordered by the city council. The streets which are in the downtown section are the following:

Douglas, from 4th to 6th; Pierce, from 3rd to 6th; Nebraska, from 4th to 6th; Fifth, from Jones to Jackson; Jones, from 29th to 32nd; 32nd, from Jackson to Jennings; Jennings, from 32d to 29th; alleys between Summit and Pearl 19th and 20th, Douglas and Pierce, and 12th and 13th.

The paving of other streets in the city is to be considered at a meeting of the council on April 21.

To Improve Trails in North Dakota

The highway system of Morton County, N. D., is to be completed without delay, according to advices received from that section of the state. Plans have been made for extending the improvement of the Red Trail and the St. Anthony Road, the Black Hills Trail from Mandan to Flasher, the Bohemian Road south of New Salem and Almont, the road north from Judson to the county line, and the road north from Sweetbriar to the county line.

The system as laid out at present includes all trails formerly used as county roads, some of which are located on lands privately owned.

Progress on the Pittsburgh-Erie Route in Pennsylvania

An agreement has been made between the Pennsylvania State Highway Department and the authorities of Beaver County whereby the county will pay one-half of the cost of constructing an improved highway over Route 77 in that county.

It is stated by the department that the work will be commenced as soon as the state highway appropriations have been made, and that the entire road from Pittsburgh to Erie, of which the road referred to is an important link, will be built with as little delay as possible.

According to advices received from the Commissioner's office, it is likely that Lawrence, Mercer, Crawford and Erie Counties will join in a similar agreement to complete the route for its entire length, the County of Allegheny having already consented to pay its portion of the expense.

An Improved Highway from Blytheville, Arkansas, to the Mississippi River, 32 mi. in length, costing about $250,000, will be under contract, it is expected, by April 15.

The Good Roads Act of Manitoba prescribes the amounts in which the government will aid the province on highway improvement, the percentage being 66 2-8 for main roads, graveled and with permanent bridges and culverts; 50% for municipal roads, graveled, and 33 1-3% for earth roads; 50% for permanent bridges and culverts; 33 1-3% for temporary bridges.

Concrete Roads*

By H. S. VAN SCOYOC†

It is a pleasure to me to again have an opportunity to discuss with you this type of road. I believe that it is safe to state that practice in concrete road construction has gone through most of its experimental stages. Experience, the most successful of all teachers, is eliminating the unnecessary frills and is crystallizing out the important steps that are demanded for satisfactory work. There are possibly two important exceptions—joints and reinforcing—and at present it is possible only to state the general trend in these two cases.

Joints

There is no doubt of a general tendency to increase the distance between joints, the average distance now probably being 50 ft. In addition, many specifications are now drawn in such a way as to vary the thickness of the joint material with the temperature or other weather conditions. It is reasonable to suppose that there will be less expansion due to temperature change in a roadway laid during the hottest part of the construction season, than in one laid early in the spring or late in the fall. There are also changes due to changes in the amount of moisture in the concrete, however, which may tend to increase or decrease the results from temperature changes. The thickness of joint material used varies from ⅛ to 1 in. Where only one thickness is specified it is usually made ⅜ or ½ in. In quite a few roads constructed during 1915 and 1916, a made joint has been eliminated entirely. In other cases joints have been placed only when the mixer closed down for a considerable period, as at noon or night. In all cases where this method is followed it is of course anticipated that transverse cracks will occur at fairly regular intervals. There is the belief that there will be less cracks to take care of eventually, however, than if joints are actually made, say, every 50 ft. In addition there seems to be less tendency to heaving and the consequent unevenness of adjoining slabs when no joints are made during construction. It is entirely likely that accepted practice may finally omit joints as a necessity during construction, but the information available at the present time is not conclusive in this respect. It is of interest, however, as showing that the mere presence of cracks is not considered a serious detriment. It is largely as cracks affect maintenance cost that they are now entering into the problem.

Reinforcing

The main justification for the use of reinforcing must lie in its providing an equally satisfactory roadway at a lower final cost than plain concrete. Its presence could scarcely be considered a detriment in any rural highway. It certainly is always desirable where subgrade conditions are bad. There is no doubt that the use of reinforcing in concrete pavement is increasing out of proportion to the general increase in yardage. Roadways of all widths are being reinforced. In my opinion there is not as yet, however, any rational basis by which to decide just when to use, or not to use, reinforcing or what weight or type of reinforcing will be most satisfactory under varying conditions. It is my belief that the most satisfactory widths for concrete roadways are 9 ft., 18 ft., 24 ft., 30 ft., etc. If proper care is exercised in the preparation of the subgrade I believe that the general use of reinforcing in a single track roadway is of doubtful economy. I doubt the necessity for reinforcing a roadway 18 ft. in width where it is laid on an evenly compacted subgrade, properly drained. I believe there are limited sections in most 18-ft. roadways that should be reinforced for special reasons.

Satisfactory Construction

When this width is exceeded I believe that unless conditions are especially favorable, it will be found desirable to use reinforcing. What I have in mind is that usually a roadway replaces a narrower previous one. The sides must be built up. It is practically impossible to get the edges properly compacted and there will be unequal settlement, which is one of the chief causes of cracks. Let us not forget that the usual weights of reinforcing will not prevent cracks. They minimize the necessity for maintaining the cracks.

We believe the most satisfactory concrete road will be secured when the subgrade is most uniformly compacted and when it is at least a foot higher than the ground level on either side, or when drainage has been provided which will keep the water level at least a foot below the top of the subgrade; when water is used freely to moisten the subgrade before the concrete is deposited, sparingly in the actual mixing and placing and unstintingly during the curing period; when the aggregates are most uniformly clean, tough and hard; when the cement is good and is combined in proportions approximately 1:2:3 and the mass properly mixed for at least a minute and deposited in a suitable manner; when the curing is carried out in such a way as to prevent the rapid drying out of the concrete by the sun and wind, and when protection is provided to prevent the injurious use of the roadway before the concrete has attained sufficient strength to withstand traffic.

Maintenance

Much misunderstanding has arisen in this connection because of statements made and not based on the same standard of comparison. In roadways properly kept up there are certain items common to all of them and which vary, not with the types of road surface used, but with the nature of the country in which the road is laid. I refer to the cutting of weeds, the cleaning out of ditches, the repairs to shoulders, guard rails, culverts, and similar work. There is also the maintenance of the road surface, which will vary with the type used, the methods of construction, the quantity and kind of traffic, etc. In some instances the first mentioned costs are almost a negligible item in the total; in others they form much the larger part.

The following statement refers only to road surface maintenance. If a concrete roadway has been satisfactorily constructed the surface maintenance, at least for a number of years, will be largely a matter of tarring cracks and joints. Usually the cost of the materials required for this work will be considerably less than the labor charges. In other words, the total cost will largely depend upon the speed with which the gang moves and the cost will not increase directly in proportion to the number of cracks because much of the time in any case is spent in going from one place to another. In 1916 the Toronto and Hamilton Highway Commission spent on filling cracks and joints in work laid in 1915, $337.05. Of this $71.61 was for materials. It was spent on 162,841 sq. yd. of concrete, of which 7,323 is 9 ft. wide, the total length being approximately 16 mi. Our gang consisted of a foreman and from three to five laborers. They used one horse and a light wagon to move them from place to place and to haul the materials and the tar kettle. We believe that a light motor truck will reduce the costs to some extent and will try out that method this season.

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*From a paper presented at the Third Annual Conference of County Road Superintendents and Engineers of Ontario, Toronto, Ont., Mar. 27-30, 1917.

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Friction Tests of Concrete on Various Sub-Bases[*]

By A. T. GOLDBECK[†]

The rational design of any structure, whether it be a bridge or a pavement, necessitates a knowledge of the stresses to which it will be subjected. In a framed structure stress analysis is comparatively simple, and may be made with practical surety. When one attempts, however, to analyze a concrete road slab one finds a bewildering maze of uncertain forces—forces that are so problematical that the rational design of concrete pavements is now rendered an impossibility. The uncertainty lies not so much in not knowing what forces exist as in an almost total lack of knowledge regarding their magnitude. We know that a concrete road slab is acted upon by forces which tend to slide it along its supporting base, which bend it, warp it, subject it to direct compression or tension, or to a combination of direct stresses and bending, forces of shear which tend to abrade its surface, and disrupting forces which weaken it locally. Practically none of these forces is known, even approximately, and until they are known progress in concrete road building must rest with excellent judgment based on precedent. This lack of knowledge is undesirable, and the present series of tests was made to throw light on at least one of the forces acting on concrete roads, namely, the force of friction at the base.

It has been shown by several investigators that concrete elongates and shortens due to two principal phenomena, change in temperature, and change in moisture content. A coefficient of 0.0000055 per degree F. seems to accurately express the effect of temperature change. Tests made by the author[**] on a number of large specimens of concrete demonstrate that moisture also plays an important part in influencing the length of concrete structures. When the moisture dries out concrete shrinks, and may shrink from this cause as much as 0.08%. On the other hand, when the moisture is retained, expansion ensues to the extent of 0.01%. Again, if the concrete is subjected to conditions alternately wet and dry, alternate expansion and contraction must inevitably result. Carefully conducted field measurements made with a specially designed instrument corroborate laboratory measurements, and show that concrete pavements are subjected to considerable motion over their sub-bases. Of course, heavy masses of concrete cannot be slid over the ground without considerable frictional resistance being offered to their sliding, and various kinds and conditions of sub-bases vary the amount of friction. In order to study the effect of the movement of pavements on the internal stresses developed, let a hypothetical case be considered in which the pavement after being laid is subjected to a rise in temperature and, in addition, due to weather and sub-base conditions is never allowed to dry out. Such a pavement will necessarily expand and the ends of the slab will move away from the center. Friction will act to resist this movement and in this way becomes an external force producing almost direct compression in the concrete. Should the frictional resistance exceed the compressive strength of the concrete, a compression failure will result. Assume another case in which the temperature decreases considerably after the laying of the pavement, and let the concrete dry out due to warm, dry weather and a well drained sub-base. This concrete will shrink, and the ends of the slab will approach its center. Friction will act against the movement, and tension will be produced in the concrete. Concrete is weak in tensile resistance, and not much shrinkage is required to crack the pavement if the sub-base is very rough. From these considerations, it will be recognized that as a step toward the rational design of concrete pavements the determination of frictional resistance at the base is necessary, and the following investigation was made with this ideal in view.

The bases of concrete roads built in the past have been of varying character. Loam, clay, old macadam, gravel, sand and many other kinds of material support the concrete, and some offer more frictional resistance than others. In laying out the present series, therefore, cognizance was taken of this fact and several different bases were used. Shallow ditches 6 in. deep, 3 ft. wide, and 7 ft. long were first dug in the soft clay soil of the Arlington Experimental Farm belonging to the U. S. Department of Agriculture. Filling material forming the sub-base was then deposited under the supervision of a trained road engineer, tamped solidly and smoothed, or otherwise treated in readiness for the placing of the concrete. A 1:1½:3 mixture was used, machine mixed to a medium wet consistency, and the slabs cast were 2 ft. wide by 6 ft. long and 6 in. thick. The various sub-bases prepared were as follows: 1—Clay, smooth top surface; 2—Clay with cobblestones partly rolled in surface; 3—Broken stone, ¾-in. to dust, flat top surface; 4—Concrete base, top surface, troweled smooth; 5—Loam, smooth top surface; 6—Sand, top surface smoothed and oiled with heavy flux oil; 7—Clay, surface scored to make it uneven; 8—Gravel, ¾-in. to ¼-in., flat surface; 9—Broken stone, 3-in; 10—Concrete base, troweled surface, oiled with heavy flux oil; 11—Sand, surface smooth; 12—Clay, oiled with heavy flux oil.

The first set of tests was made when the specimens were one month old. A frame made of a piece of ½-in. round steel bent to surround the specimen was fastened to the pulling chain, which in turn was linked to a spring dynamometer. Force was applied by means of a light steel rail used as a long lever. Two men at the end of the lever were able to apply a constantly increasing force with great steadiness. The movements of the slab were read by means of a Berry strain gauge, and in this way the movements corresponding to known loads were obtained.

On Plate 1 are plotted the forces required to slide the specimens, together with their corresponding movements. Each specimen weighed approximately 870 lb.. The ground during these tests was damp but very firm. It will be noted that movement takes place almost as soon as the load is applied in all cases except that in which large broken stone was used in the base. Here there is great friction from the start until finally, when a load of 1,000 lb. is reached slipping begins to take place. Great force was required to start the slab, after which no more was necessary than in some of the other bases. Apparently there is no such thing as a constant coefficient of friction, but this varies depending on the displacement. When the slab on the loam base had been slid 0.035 in., the load was gradually released, and the return movement noted on the strain gauge. This movement is shown by the dotted curve. The sub-base seemed to behave in a somewhat elastic manner as the slab actually recovered considerable of its forward movement. This can be accounted for only by the partial springing of the sub-base back into its original position, carrying the slab along with it.

The values of the frictional resistance offered at various displacements are given in Table I.

The same specimens and a few more that had been completed in the meantime were again pulled after a period of about a month and a half. During this interval the ground was frozen solid almost all of the time, but the day before the tests a thaw set in and, combined with rain, served to make the ground exceedingly muddy. The bases of most of the specimens were thoroughly saturated with water, which stood on the surface in small puddles. The results obtained under such conditions are shown on Plate II, and it will be noted that the friction is considerably lower than it was in the previous tests. The water therefore acted as a lubricant and permitted of the easy slipping of the slabs. The values of the frictional resistance offered at various displacements are expressed in Table II.

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[*] Paper presented at the 1917 annual meeting of the American Concrete Institute, Chicago, Ill.

[†] Engineer of Tests, Office of Public Roads and Rural Engineering, U. S. Department of Agriculture.

[**] The Expansion and Contraction of Concrete while Hardening, by A. T. Goldbeck, 1911 Proceedings of American Society for Testing Materials.

The Expansion and Contraction of Concrete while Harden-Roads, by A. T. Goldbeck and F. H. Jackson, Jr., U. S. Office of Public Roads Bulletin now being printed.

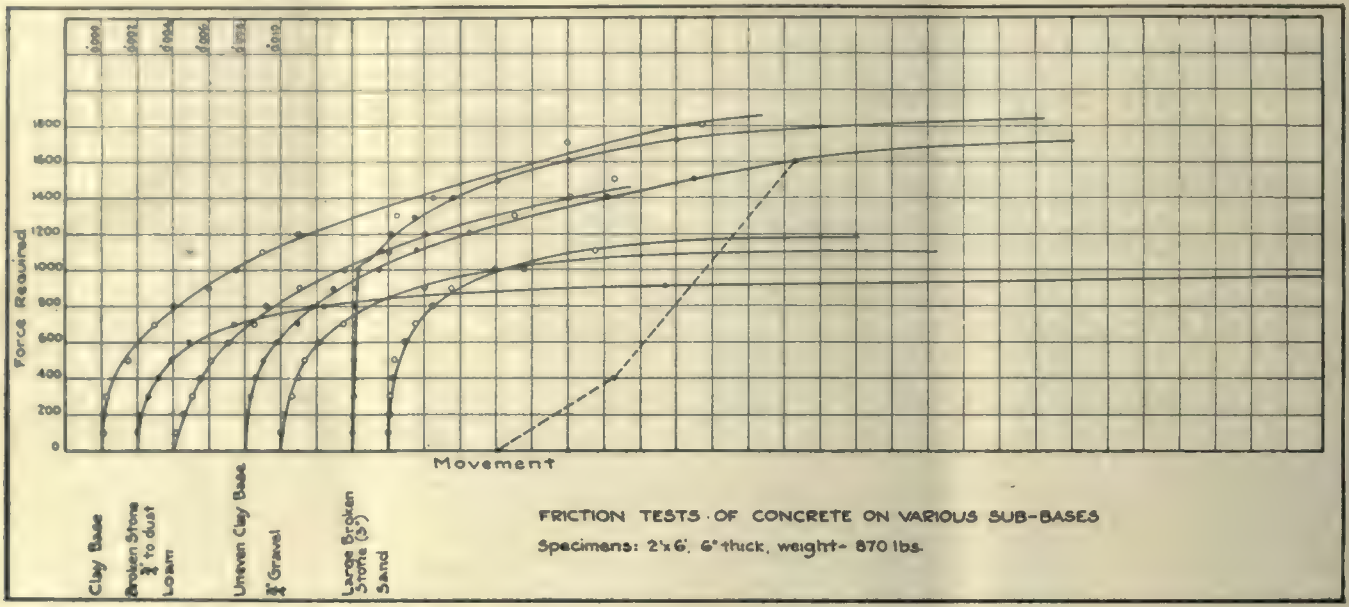

PLATE I.—FORCES REQUIRED TO SLIDE SLABS ON SUB-BASES.

TABLE I.—FRICTIONAL RESISTANCE OF CONCRETE ON VARIOUS SUB-BASES.

Note: Bases were somewhat damp but very firm. Weight of specimen, 870 pounds.

Kind of Base.	Movement.	Force.	Coefficient.	Movement.	Force.	Coefficient.	Movement.	Force.	Coefficient.
Level clay....	0.001	480	0.55	0.01	1130	1.30	0.05	1800	2.07
Uneven clay..	0.001	500	0.57	0.01	1120	1.29	0.05	1800	2.07
Loam	0.001	300	0.34	0.01	1030	1.18	0.05	1800	2.07
Level sand...	0.001	600	0.69	0.01	1080	1.24	0.05	1200	1.38
¾-in. gravel..	0.001	450	0.52	0.01	960	1.10	0.05	1100	1.26
¾-in. broken stone	0.001	380	0.44	0.01	800	0.92	0.05	950	1.09
3-in. broken stone	0.001	1060	1.84	0.01	1550	1.78	0.05	1900	2.18

The results in Table II, when compared with those given in Table I, show very clearly that much depends upon the moisture condition of the sub-base. A wet sub-base permits the concrete to slide very much easier than does a dry sub-base. This apparently also applied to the specimens mounted on broken stone and gravel bases, particularly when the movements were small. In order to try the effectiveness of a heavy oil coating for decreasing the friction at the sub-base, several specimens were made having sand, clay, and concrete sub-bases treated with a heavy flux oil. The oil was applied while hot and was spread over the surfaces with a broom in a layer of sufficient thickness to completely cover the sub-base. The concrete was deposited on these oiled bases immediately. So far as could be noticed, the oil was not effective in decreasing the friction in any of the bases, even when applied to the concrete base that had been carefully troweled smooth. It was impossible to slide the concrete specimen with respect to the concrete base, even when a load of 2,500 lb. was applied. No attempt was made to apply a greater load than this, because 2,500 lb. was the limit of the dynamometer. When the maximum load had been reached in some of the specimens it was slowly released and the recovery of the specimen noted. In some instances this amounted to almost ¼ in. It thus becomes very plainly evident that when the concrete slides over the sub-base there is a considerable amount of yielding of the base material, and it is therefore to be expected that if the material were fairly homogeneous,

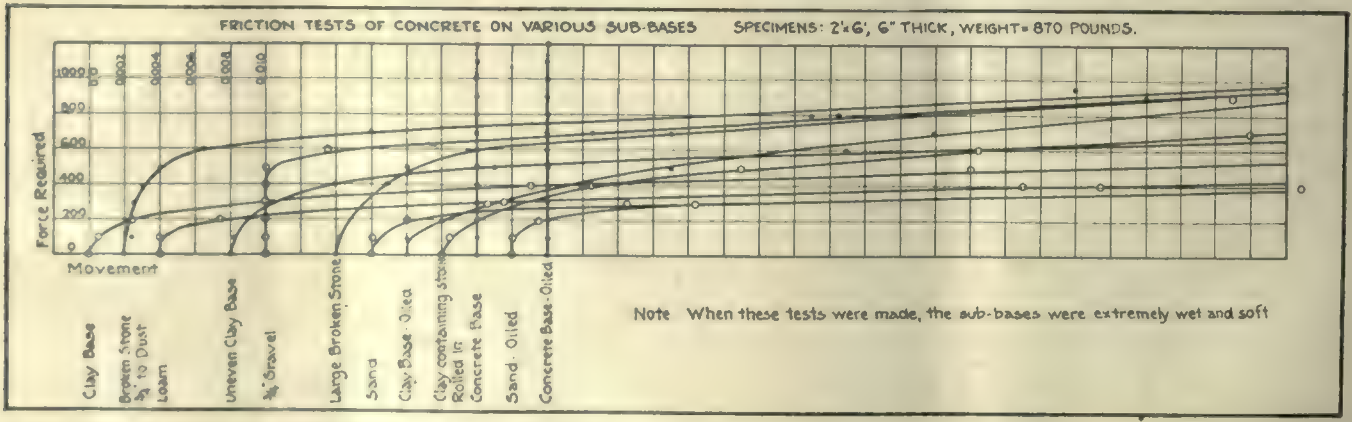

PLATE II.—FORCES REQUIRED TO SLIDE SLABS ON SUB-BASES.

and the movement of the concrete took place slowly, the material of the sub-base would gradually yield under this movement, and would thereby offer less resistance than these tests seem to indicate.

In considering friction results, the maximum resistances are naturally of greatest importance, since these create the greatest stresses. Those given in the first table are therefore of more interest than in the second, and these results very clearly show that the friction varies considerably in the sub-base, depending upon its character. The indications are that the friction can be greatly decreased if proper care is given to the preparation of the sub-base. Every ridge or depression that is in the sub-base surface before concrete is deposited furnishes an additional grip for the concrete, thereby tending to elastically deform a larger amount of base material, and thus offering greater resistance to the sliding of the concrete.

The formation of transverse cracks in concrete bases can readily be ascribed to direct tension due to frictional resistance at a time when the concrete is contracting, whether this is caused by decrease in temperature or by drying out of the moisture. The test results show that the coefficient of friction can readily vary from almost 0 to something over 2 or more, depending upon the movement of the concrete and the character of the sub-base. The distance between transverse cracks is dependent upon the coefficient of friction, and the total force of friction must extend over this distance. Calling the coefficient of friction "f," the distance between cracks "D," the weight of the pavement per square foot "w," we may write the equation: $fwD =$ tensile strength of concrete per foot of width. Assuming the tensile strength of concrete to equal 200 lb. per sq. in., the pavement to be 6 in. in thickness, the weight of a cubic foot of concrete to be 150 lb., and the coefficient of friction to equal 0.5, this equation reduces to: $0.5 \times 75 \times D = 72$ sq. in. $\times 200$, or $D = 370$ ft. If the coefficient of friction equals 2, the distance between cracks equals 90 ft.

TABLE II.—FRICTIONAL RESISTANCE OF CONCRETE ON VARIOUS SUB-BASES.

(Sub-bases thoroughly saturated with water and surrounding ground exceedingly soft).

Weight of specimen: 870 Pounds.

Kind of Base.	Movement.	Force.	Coefficient.	Movement.	Force.	Coefficient.	Movement.	Force.	Coefficient.	Movement.	Force.	Coefficient.
Level clay	0.001	120	0.14	0.01	300	0.35	0.05	500	0.58	1.5	950	1.09
Uneven clay	0.001	200	0.23	0.01	460	0.53	0.05	620	0.71	1.4	925	1.06
Loam	0.001	150	0.17	0.01	260	0.3	0.05	410	0.47	0.75	925	1.06
Level sand	0.001	140	0.16	0.01	280	0.32	0.05	400	0.46	0.75	875	1.00
¾-in. gravel	0.001	510	0.58	0.01	640	0.73	0.05	950	1.1	0.5	1050	1.2
¾-in. broken stone	0.001	400	0.46	0.01	660	0.76	0.05	940	1.08	2.0	1160	1.33
3-in. broken stone	0.001	240	0.28	0.01	630	0.73	0.05	900	1.04	0.875	1625	1.87
Oiled clay	0.001	150	0.17	0.01	410	0.47	0.05	850	0.98	1.25	1425	1.64
Clay & cobblestones	0.001	140	0.16	0.01	410	0.47	0,05	710	0.82	1.75	1260	1.45
Concrete base	0.000	2500	2.9	0.00	2500	2.9	0.00	2500	2.9	0.00	2500	2.9
Sand, oiled	0.001	180	0.21	0.01	280	0.32	0.05	480	0.55	0.375	800	0.92
Concrete, oiled	0.000	2500	2.9	0.00	2500	2.9	0.00	2500	2.9	0.00	2500	2.9

It is conceivable that conditions may exist in which the frictional resistance may mount much higher than this, and may be excessive in spots. It would seem desirable to reduce the friction by careful preparation of sub-base so that it is made as smooth as possible. It can very readily be shown mathematically that the forces of friction aid the force of gravity in causing concrete slabs to move downhill. The effect of this movement sometimes shows up very plainly in expansion joints, as it tends to make one side of the joint ride up on the other. The pavement may thus be compared to a train of cars, each slab bumping into its neighbor, and preventing the expansion joints from functioning properly.

If the forces of friction are to be controlled and rendered capable of analysis, would it not be well to prevent free movement of the slab at some point, so that the length along which the forces of friction are acting may be definitely determined?

Finally, would it not be well to pay more attention to the preparation of a smooth sub-base having minimum friction?

Increase in Automobile License Funds in Pennsylvania

Information recently furnished by the State Highway Department of Pennsylvania is to the effect that the total receipts from automobile licenses for the year 1917, up to April 1, amount to $2,147,742, an increase of $734,511 over the same period last year.

The entire fund is now available for maintenance of highways and they are being put into good conditions as rapidly as possible in every district of the state.

New York State Bonds Sold

Twenty-five million dollars of bonds for the improvement of highways and canals in New York and the acquisition of lands for forest preserves and the Palisades Interstate Park, referred to in a pervious issue, were sold at Albany on April 5 to a syndicate composed of Kuhn, Loeb & Co., Kidder, Peabody & Co. and Wm. A. Read & Co., the highest bidder. A premium of $1,204,250 will accrue to the state from the bonds, which bear 4% interest and are exempt from taxation.

Motor Truck Loads Limited in Maryland

The present law regulating the loads carried by motor trucks in Maryland fixes the number of pounds per inch width of tire surface at 650, and this law is to be strictly enforced after Oct. 1, 1917.

The last legislature was asked by the State Roads Commission to limit the weight to 500 lb., but a compromise was reached after many conferences between the commission and representatives of the motor truck owners whereby 750 lb. per inch width of tire surface will be permitted until May 1, 1917, and 800 lb. from that date until Oct. 1, on certain roads radiating from Baltimore. The roads are as follows: Bel Air Road, to Perry Hall; Harford Road, to Carney; York Road, to Towson; Falls Road, to Mount Washington; Park Heights Ave., to Valley Road; Reisterstown Road, to Carroll County line; Liberty Road, to Buck's Lane; Washington Road, to Winans; Westport, to Glenburnie.

The agreement does not affect any other roads in the state.

At Recent Elections in Milan County, Texas, bonds for $150,000 were voted in Road District No. 10; $20,000 each in districts Nos. 7, 9 and 11, and $15,000 in district No. 12, all for highway construction.

New York State Prisoners are in favor of working upon the roads, according to the National Committee on Prisons and Prison Labor. In a recent number of the "Bulletin" which is issued by the prisoners, reference is made to excellent results obtained during 1916 on road work in Westchester County and elsewhere, and it is stated that it has been the means of restoring the strength and energy of the prisoners. It is stated that none of them had any fault to find with their treatment, and that many inmates were anxious to show that they had reformed.

Road Laws of Ohio Amended

The General Assembly of Ohio recently passed by unanimous vote a law, known as the White-Mulcahy bill, amending in some respects the Cass law enacted two years ago. The essential effect of the measure, which is characterized as a decided advance in Ohio road legislation, is to correct certain phases of existing law and supply omissions therein, and it is based upon the especial needs and conditions of communities throughout the state.

The sections of the law relating to bonds have been simplified, and provision is made for extending aid to municipalities that are unable to build connections with roads on which improvements end at corporate limits.

The new law provides for the establishment of a board to be known as the Highway Advisory Board. This is to consist of four members, no two of whom may be of the same political party, and must be consulted by the state highway commissioner, on matters of general policy, with especial reference to changes in the state system of highways or administration, and cooperation with the federal government.

The duties and authority of the county surveyor, the title adopted for the "county highway superintendent," are clearly set forth. He shall give his entire time and attention to the duties of his office and shall receive an annual salary computed as follows: One dollar per mi. for each full mile ot the first 1,000 mi. of public county roads, and in addition $40 per thousand for each full 1,000 of the first 15,000 of the population of the county as shown by the federal census next preceding his election, $30 for each 1,000 of the second 15,000, $25 for each 1,000 of the third 15,000, $15 for each 1,000 of the fourth 15,000 and $5 for each 1,000 of population in excess of 60,000; also in each county in which on Dec. 15, 1915, the aggregate of the tax duplicate for real estate and personal property was $25,000,000 or more, the sum of $50 for each full $1,000,000. It also provides an additional compensation per million dollars on the aggregate of the tax duplicate for real estate and personal property, on the basis of $25,000,000, but in no case shall the salary of the county surveyor exceed $6,000 a year.

Under the sections relating to his duties and authority the county surveyor is given charge of all highways, bridges and culverts within his county under control of the state, unless a special engineer is appointed by the state highway commissioner, and general charge of the construction, maintenance and repair of all bridges and highways within his county under the jurisdiction of the county commissioners. He is also given general charge of the construction, reconstruction, resurfacing or improvement of roads by township trustees under sections of the law, and of such work in road districts under other sections, but he has no authority in connection with the repair, maintenance or dragging of roads by township trustees, unless requested by the board of township trustees to give advice as to methods.

A special feature of the bill is the provision made for the naming and numbering of all the public roads of the county, other than inter-county highway or main market roads, and all bridges and culverts on such roads. This must be done by the county surveyor under the direction and supervision of the state highway commissioner. It is provided that all such roads shall be divided into sections where they are of sufficient length to warrant the same, no section exceeding 3 mi. in length, and numbered consecutively, the provision extending to roads on the north and east lines of each county. The county surveyor must make a map of such roads showing by number, location and length each such road and section thereof and all bridges and culverts. The map must also show the location of municipal corporations, schoolhouses, churches, lakes and rivers, and must be made in township units. Descriptions or identifications must be entered in a book kept in the county surveyor's office. A copy of the map with such further information as may be required must be submitted to the state highway commissioner, who must issue such instructions as he deems proper for carrying out the work. Copies of the map are to be filed in the office of the county surveyor and in the office of the county commissioners, and a copy of the map of each township must be filed with the township trustees of such township, and the official terms thereafter used in referring to roads, etc., so designated. When a new road is established it must be designated, and added to the map and reported to the state highway commissioner and the county commissioners.

Before issuing any warrants for moneys expended by the county on any county highways, bridges or culverts, the county auditor must require of the county surveyor the assignment of such expense to the road and section thereof upon which the expense was incurred, and the auditor must keep such records as are necessary to show at the close of each year the amount expended on each section of road, other than inter-county highways or main market roads. The township clerk before issuing a warrant on the township treasurer, must require of the county surveyor or township trustees the assignment of such expense to the road or section thereof, or bridge or culvert in connection with which the expense was incurred. The cost of general equipment for use in the entire county or township need not be assigned to any section, but so far as practicable all items of expense must be assigned to the specific work upon which they are incurred. All county auditors and township clerks may at any time be required to transmit to the state highway commissioner cost records pertaining to roads, bridges and culverts within their counties or townships.

The county surveyor is required to call an annual meeting within the county, at a time and place approved by the state highway commissioner, of all county and township road authorities, looking toward the development of a uniform system of highway work for the county. The meeting must be open to the general public.

Township trustees are given authority to establish a road district in a township where the tax is so high as to prohibit the making of a general levy. The construction of township roads is carried out by the trustees under the direction and supervision of the county surveyor, and under a plan similar to that of the county. The trustees have complete authority over the repair and maintenance of roads and bridges and the dragging of earth and gravel roads in the township. The dragging of roads is mandatory and an appropriation for this work must be the first made from township funds. This gives to township authorities the rights for which they have long contended.

The new law goes into effect in June, 1917, subject to a referendum.

The Ohio legislature by the enactment of Senate Bill No. 55 has placed the State Highway Commission in position to receive the state's apportionment of federal aid under act of July, 1916.

A Plan of Cooperation in Planting Trees Along the State Highways of Pennsylvania has been effected between the Pennsylvania Department of Forestry and the State Highway Department. The initial work of growing the trees from seed will be done by the former, and when the trees are of suitable size they will be turned over to the highway department for transplanting. Scotch, white, and pitch pine, Norway spruce, Douglas fir, sugar maple, white ash, white elm, black cherry, honey locust and European larch are the species that so far have been planted along the roads.

GOOD ROADS

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Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

APRIL 14, 1917.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, OF GOOD ROADS, published weekly at New York, N. Y., for April 1, 1917.

State of New York, County of New York, ss.:

Before me, a Commissioner of Deeds, in and for the State and county aforesaid, personally appeared E. L. Powers, who, having been duly sworn according to law, deposes and says that he is the Editor and General Manager of Good Roads, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, and circulation of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in Section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor and business managers are:
Publisher—The E. L. Powers Co. (Inc.), 150 Nassau St., New York, N. Y.
Editor—E. L. Powers, 150 Nassau St., New York, N. Y.
Managing Editor—T. A. Hulbert, 150 Nassau St., New York, N. Y.
Business Manager—E. A. Lyman, 150 Nassau St., New York, N. Y.

2. That the owners are:
The E. L. Powers Company, Inc., 150 Nassau St., New York, N. Y.
E. L. Powers, President and Treasurer, 150 Nassau St., New York, N. Y.
H. L. Powell, Secretary, 150 Nassau St., New York, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent. or more of total amount of bonds, mortgages, or other securities are: No bondholders, mortgagees or other security holders.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is: (This information is required from daily publications only).

E. L. POWERS, Editor and General Manager.

Sworn to and subscribed before me this 2nd day of April, 1917.
(Seal) O. D. CONKLIN,
Commissioner of Deeds: Certificate filed in New York County Clerk's Office, No. 74; New York Register's No. 18026. Commission expires March 18, 1918.

HIGHWAY ENGINEERS AND THE WAR

In the present crisis in the affairs of the nation every American must face the question of his duty as a citizen, must realize that unless there is a speedy termination of the war that has spread through most of Europe and finally involved this country, he must meet the obligations imposed upon him by the benefits he has received and has perhaps come to look upon too much as a matter of course. That every one must help is obvious; just how he shall "do his bit"—as the expressive phrase has it—is not so clear.

While the course that perhaps first suggests itself is fighting in the trenches or on the seas, it would not be the most effective service for all, even of those physically qualified for it. The actual fighting force is by no means the only necessary instrumentality of modern warfare, in which, as in industry, machinery plays a large part. The conduct of war is not founded on sentiment and though a man's patriotism led him to offer himself for use on the firing line, yet if he could contribute more in some other capacity, he would be no more justified in making that sacrifice than his country would be in accepting it.

War is largely a matter of engineering and, as such, must be directed largely by engineers. Every war in history—and none more than the present war—has demonstrated the military value of roads. Road building, therefore, must inevitably form an important part of any extensive land campaign. That roads are essential to adequate preparations for defense has been urged many times.

Whatever the United States may do toward aiding in military operations in Europe or preparing this country for defense, the civilian road builders constitute a potential force of enormous possibilities. How this force shall be used must be left to the government and at present highway engineers, as a body, can best serve their country by placing their services at its disposal, through their various organizations. Something has already been done by societies, technical schools and other institutions in the way of listing resources and gathering data, and, under the guidance of the military authorities, much more can probably be accomplished. Besides this work, and the acquirement of such information as is possible relative to the practice of their art as modified by the exigencies of war, highway engineers should undertake whatever they can find to do toward aiding in the active preparations that must be made in the months to come.

A NOTEWORTHY FEATURE OF THE NEW OHIO ROAD LAW

Among the provisions of the new highway law of Ohio, reviewed at some length elsewhere in this issue, is one that should greatly enhance the efficiency and economy of work on local roads. The provisions referred to are contained in sections 7188-1 and 7188-2, and, we believe, are a step in the right direction.

Stated briefly, these sections make it incumbent upon the county surveyor in each county to assign names and numbers to all roads and sections of roads within his jurisdiction, except intercounty highways and main market roads; to record these upon maps and otherwise; and to assign to each road and section of road the expenditures made upon it. There is also laid upon county and township officials the obligation of keeping their records of expenditures in accordance with the county surveyor's assignments and in conformity with rules to be prescribed by the state highway commissioner. These provisions extend to bridges and culverts situated on the roads, and must be complied with in all counties and townships in the state by Jan. 1, 1919.

If the law is enforced—as it is to be hoped that it will be, in spite of the absence of penalties for non-compliance—it will mark a great advance toward the centralization of authority so necessary to the performance of road work.

of all kinds in an economical and satisfactory manner. At present the greatest wastes of money and effort are on the local roads. Most townships and many counties are too small to be administrative units in road improvement and as a consequence they frequently lack competent supervision of the work done. Often the only report required of the road officials is a statement to the effect that a certain sum was spent for "road work" or that so much was used on such and such a road. Such slip-shod methods of accounting and reporting facilitate the covering up of incompetency, especially as the average taxpayer takes little interest in the reports of public officials even if they are brought to his attention. The local officials are generally in no way accountable to a central authority, and even when the laws do provide that reports of expenditure must be made to some state department or official, the latter seldom is given power to enforce the provision and can secure only incomplete returns that are of little value.

The Ohio law, by the provision that reports shall be made in accordance with terms prescribed by the state highway commissioner and the state auditor, makes it possible to secure uniform data that will show definitely what use has been made of the funds applied to local road work. These records must be transmitted to the state highway commissioner at any time he calls for them.

Patrol Maintenance in Maine

Two circular letters dealing with the subject of road maintenance by the patrol system have recently been sent out by the State Highway Commission of Maine to officials of cities and towns throughout the state. One circular is an explanation of the patrol maintenance law and the other a statement of the state's plans for the coming season.

The first mentioned circular, after calling attention to the fact that boards of selectmen have made inquiries as to certain features of the patrol maintenance law, continues as follows:

"We are advised by the attorney general that the highway commission has no authority to relieve any town from the provisions of this law and that the general appropriation for roads and bridges includes all special appropriations except sidewalks, but we do not understand that this includes appropriations to entitle the town to state aid, or to special resolves of the legislature, or money raised under the new bridge law.

"The intention of the law, as we understand it, is that patrol maintenance is to include the maintenance of improved state highways and improved state aid highways together with such mileage of unimproved roads as may be mutually agreed upon between the municipal officers of the town and the State Highway Commission. We do not understand that the law contemplates that towns shall make any special appropriations to take care of this expense. On the other hand, we can see no reason why towns may not make such special appropriations to take care of this expense if they see fit to do so. If no special appropriation has been made the amount required shall be taken from the road and bridge money.

"As we understand the law towns will be expected to pay to the state treasury not to exceed $60 per mile for each mile of improved state highway and not to exceed $30 per mile for each mile of improved state aid highway under patrol maintenance. On the unimproved mileage patrolled the towns shall pay an amount which shall equal the average amount per mile raised by the town for the care of roads and bridges multiplied by the number of miles of unimproved roads patrolled. This amount per mile shall not be less than $30 nor more than $60. The law in regard to roads under patrol may be explained by the following illustration:

"For example, if there are 75 mi. of highway in a town, exclusive of improved state or state aid highway, and the appropriation for roads and bridges in that town is $3,750, this would be an average of $50 per mi. and $50 per mi. would be the amount required by the state from the town on the unimproved mileage that is under patrol. Furthermore, if 8 mi. of road are designated for patrol maintenance and 2 mi. of this is a state highway, the town would pay on this not to exceed $60 per mi., or $120. If, in addition to this, there are 2 mi. of state aid road patrolled the town will pay on this not to exceed $30 per mi., or $60, and if the unimproved road patrolled is 4 mi. in length the town would be expected to pay on this $50 per mi., or $200.

"To the town's appropriation will be added the state's apportionment, making the joint fund."

According to the other circular, the State Highway Commission, in planning work for the coming season, has attempted to retain the services of all patrolmen who did satisfactory work last season and at the same time has attempted to replace patrolmen whose work was not satisfactory last season.

The state's apportionment for patrol maintenance this year, it is stated, will be about the same as last year, where the mileage to be covered is the same. In addition, however, the commission has voted to apportion to each town where the maintenance is taken care of by a patrolman the sum of $50 for carrying on early work on the roads, provided the town will furnish an equal amount. The commission regards this money as an extra expenditure and not as part of the patrol maintenance fund, and, in the work to be done with it, expects only so much of the sum to be expended as is necessary to put the patrolled roads in good condition. The work is expected to be done under the supervision and direction of the inspectors of the State Highway Commission.

NEWS NOTES

Citizens of Selmer, Tenn., are planning to build a turnpike to the Tennessee River, a distance of 30 mi.

Highway Work in Southern Arkansas on roads having a total length of 160 mi. and traversing five counties will be started by early summer, according to a report. The cost of construction is estimated at $4,000,000.

The Commissioners Court of Harris County, Tex., contemplates calling an election of taxpayers to vote on issuing $2,000,000 in bonds, the proceeds to be used in constructing concrete highways.

One Hundred Miles of Improved Roads for Yakima County, Washington, may be the result of a campaign which has been in progress in the county since the first of the year. A bond issue of $1,500,000 is proposed to pay for the work, and it is expected that an election will be called within a few weeks to decide the question.

A Fund for Beautifying the Lincoln Highway in Nevada was proposed at a recent meeting of the Lincoln Highway Committee of the State Federation of Women's Clubs at Reno. The plan is to install drinking fountains and to plant shade trees where they can be irrigated along the road in Nevada, and to provide some one to take care of them.

The San Francisco Office of the U. S. Forest Service will issue weekly reports, commencing early in April, on the condition of the principal automobile roads in the national forests of California. The information will be obtaned from forest rangers and will be given to the press, automobile clubs, hotels and interested organizations. There are twenty national forests in the state, containing about 8,600 mi. of road, and 9,500 mi. of trail. Other mileage will be added under the provisions of the federal aid road act which makes available $281,751 for the fiscal years of 1917 and 1918. It is estimated that the improvement of 837 mi. of road will be necessary to provide an adequate system for the California national forests, 663 mi. of which would lie in the forests and the balance in nearby localities.

MEETINGS

Calendar of Coming Meetings

April 16-18.—Portland Cement Association—Spring Convention, San Francisco, Cal. Secretary, F. L. Page, 111 West Washington St., Chicago, Ill.

April 17-20.—U. S. Good Roads Association—Fifth annual convention, Birmingham, Ala. Secretary, J. A. Rountree, 1021 Brown Marx Building, Birmingham, Ala.

May 7-9.—National Conference on City Planning—Annual Conference, Kansas City, Mo. Secretary, Flavel Shurtleff, 19 Congress St., Boston, Mass.

May 23-24.—Michigan State Good Roads Association—Annual meeting, Saginaw, Mich. Secretary, A. A. Anderson, Hastings, Mich.

June 11.—New York State Conference of Mayors and Other City Officials—Annual Conference, Buffalo, N. Y. Secretary, W. P. Capes, 25 Washington Ave., Albany, N. Y.

June 26-30.—American Society for Testing Materials—Annual meeting, Atlantic City, N. J. Secretary, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

Fourth Canadian and International Good Roads Congress

Under the auspices of the Dominion Good Roads Association, the Fourth Canadian and International Good Roads Congress opened at Ottawa, Ont., at 2:30 p. m., Tuesday, April 10, following the program outlined in a previous issue. The congress will close today.

Road Meetings in Maine

The Maine State Highway Commission has arranged for a series of meetings in various cities of the state for the purpose of meeting selectmen, road officials and others interested in the general questions of road improvement. These meetings are intended to give opportunities for the clearing up of questions which may exist in the minds of municipal officials, and the commission hopes for a good attendance at each. The meetings scheduled are as follows:

Portland, Tuesday, April 17, 1:30 p. m., Chamber of Commerce; Auburn, Wednesday April 18, 10:00 a. m., Court House; Augusta, Friday, April 20, 10:00 a. m., State House; Presque Isle, Tuesday, April 24, 10:30 a. m., Mooselenk Club; Bangor, Wednesday, April 25, 1:15 p. m., Court House; Machias, Thursday, April 26, 10:00 a. m., Court House; Belfast, Tuesday, May 1, 10:00 a. m., Court House; Bath, Wednesday, May 2, 11:00 a. m., Court House; Rockland, Thursday, May 3, 11:00 a. m., Court House.

National Parks Highway Association

Announcement has been made of the annual meeting of the National Parks Highway Association at Spokane, Wash., at 10 a. m., April 27. The meeting will be held in the assembly rooms of the Chamber of Commerce.

The purpose of the meeting is to bring together representatives of communities along the highway from the Great Lakes to Puget Sound, for the consideration of plans for broadening the work of developing the highway and bringing it to popular attention. The questions of permanent marking and the securing of federal aid funds will be discussed.

Traffic counts made at Seattle, Ellensburg, Missoula, the Missouri River Crossing, and by the government at the Gardiner entrance to Yellowstone National Park indicate that no fewer than 5,000 tourist automobiles averaging three persons to the car, used the National Parks Highway during the 1916 season. It is estimated that 10,000 cars will go over the road during the 1917 season.

Officers of the association are: President, W. G. Edens, Chicago, Ill.; Treasurer, Earle P. Browne, Coeur d'Alene, Idaho; Secretary, Frank W. Guilbert, Spokane, Wash.

Florida State Good Roads Association

The twentieth annual convention of the Florida State Good Roads Association was held at Tallahassee on Wednesday and Thursday of this week. Much of the time of the convention was devoted to Florida road topics, not only from the standpoint of general improvement throughout the state but along lines relating to specific highways. The reports submitted indicated considerable progress in the work of the association during the past year. One session was devoted to "Woman's Part in Highway Improvement and Beautification."

Road Meetings in Missouri

A series of meetings to be held at various places in the state has been arranged by the new State Highway Commission of Missouri. The plan is in the nature of an educational tour, for acquainting the people with the workings of the new road laws as well as for taking up the question of general highway improvement.

The meetings will be conducted by the commissioners and the engineering staff, and will occur as follows:

First District, 22 counties, St. Joseph, April 16; Second District, 22 counties, Hannibal, 17th; Third District, 18 counties, Joplin, 20th; Fourth District, 18 counties, Jefferson City, 19th; Fifth District, 20 counties, Springfield, 21st; Sixth District, 16 counties, Cape Girardeau, 23d.

Tri-State Good Roads Association

The two-day program of the fourth annual convention of the Tri-State Good Roads Association, to be held in Medford, Ore., May 16-17, as previously announced in "Good Roads," includes addresses by Gov. Lister of Washington, Gov. Withycombe of Oregon and Gov. Stephens of California. It is expected that highway commissions and road builders of all classes from the three coast states will be in attendance.

It is pointed out that the roads of the coast will be in good condition in May, and many excursions are planned for visitors, notably an automobile trip into the Siskiyou Mountains. Arrangements are being made for entertaining a large number of visitors.

Geo. E. Boos, of Medford, Ore., is Secretary of the association.

A special road meeting was held at Watertown, S. D., on March 27, and was attended by one hundred and fifty residents of communities between Granite Falls, Minn., and Rapid City, S. D. The meeting resulted in the organization of an association for establishing a highway from Minneapolis to the Pacific Coast by way of Granite Falls, Watertown, Redfield, Miller, Pierre and Black Hills, S. D., Sundance, Wyo., and Yellowstone Park, south to north entrance.

At the closing session of the Blair County Road Supervisors' Association meeting at Hollidaysburg, Pa., on Mar. 23, officers were elected as follows: President, W. L. Hayes of Taylor Township; First Vice President, W. W. Stewart of Tyrone; Second Vice President, David Irwin of Antis Township; Secretary, Isaac Krider of Duncansville; Treasurer, J. E. Black of Logan Township.

The Dumbarton State Highway Bridge Association was organized in San Francisco, Cal., in March, for the purpose of aiding the campaign for the construction of a highway bridge across the lower end of San Francisco Bay. Offices of the association will be in the Monadnock Building.

LETTER TO THE EDITOR

Stone-Filled Sheet Asphalt Paving

Editor, "Good Roads:"

The writer has had a request from one of the trade periodicals to know whether or not stone-filled sheet asphalt paving, as recommended in the writer's book, "Paving Economy," is controlled through any monopoly of patents, or otherwise.

In order that there may be no misunderstanding we would advise you that there is no control whatever of this type of pavement as the writer lays it and recommends it. Any one who has, or will secure, the necessary information and equipment can proceed to do the work without leave or license from any one.

This form of pavement is not very different from the fine asphalt concretes and the so-called Topeka mixtures. It varies in grading in being more of a sheet asphalt; in fact it is a standard sheet asphalt to which fine stone chips have been added in a quantity and size that fall within the Topeka court decree.

C. A. MULLEN,
Director of Paving Department,
Montreal, P. Q. Milton Hersey Co., Ltd.

PERSONAL NOTES

L. C. Lawton was recently reelected City Engineer of Haverhill, Mass.

E. G. Dunn has resigned the position of City Engineer of Michigan City, Ind.

R. S. Tiernon has been appointed by the Governor of Kansas as a member of the State Highway Commission.

J. R. Wilson has been appointed Special Road Engineer for the Lincoln District of Marion County, Pennsylvania.

Frank H. Adams, former Bridge Engineer for King County, Washington, died recently at Providence in that state.

J. S. Neibert, City Engineer of Denton, Texas, resigned on March 31 to accept a position with H. O. Compton, of Liberty, Texas.

David A. Decker, formerly Assistant City Engineer of Norfolk, Va., is now associated with Gilbert C. White, Consulting Engineer, of Durham, N. C.

Ernest S. Alderman, formerly of the U. S. Office of Public Roads and Rural Engineering, has been placed in charge, as Supervising Engineer, of the expenditure of a $500,000 bond issue passed by Beauregard Parish, Louisiana.

Erwin O. Hathaway who, for several years has been Senior Highway Engineer in the U. S. Office of Public Roads, was recently appointed United States District Engineer for the Fourth District, and will have his headquarters at Minneapolis, Minn.

E. R. Moses has been appointed by the Governor of Kansas a member of the State Highway Commission.

P. D. Van Vliet, of the Universal Portland Cement Co., Chicago, Ill., has been made Publicity Manager of the company.

Robert A. Meeker has been reappointed State Highway Engineer of New Jersey, with an advance in salary from $4,000 to $7,000 a year.

Capt. J. R. Pennell, of Belton, South Carolina, has been elected by the State Highway Commission as State Highway Engineer at a salary of $3,000 a year. Capt. Pennell is a graduate in civil engineering of the University of South Carolina, and commands Company A, South Carolina Engineers.

Zenas W. Carter, formerly Field Secretary of the Granite Paving Block Manufacturers' Association, has been appointed Commissioner of the Publicity Bureau of the Associated Metal Lath Manufacturers, with headquarters at Cleveland, Ohio. Mr. Carter will supervise the publicity, promotion and investigation undertaken by the association.

PUBLICATIONS

CONCRETE HIGHWAY BRIDGES, GENERAL SPECIFICATIONS. Appendix to the annual report on highway improvement, Province of Ontario, Can., 1917. Paper, 6½x9½ in.; 23 pp.

This publication includes general specifications for concrete bridge structures issued by the Ontario Department of Public Highways. There are included in the specifications besides general clauses, sections relating to piles and pile foundations, loading, the proportioning of parts, materials, mixing and placing concrete, abutments and wing walls, concrete floors on steel bridges, forms and excavation and grading.

ASPHALT PAVEMENTS—SPECIFICATIONS AND PROPERTIES. Bulletin No. 12 of Kansas City Testing Laboratory. Paper, 5½x8½ in., 19 pp. Issued by the Kansas City Testing Laboratory, 1013 Grand Ave., Kansas City, Mo. $.50.

The contents of this booklet include descriptions of asphalt and asphaltic pavements of various kinds, data on the cost of asphalt pavements, specifications for the construction of asphaltic concrete pavements and for asphaltic cement for surface mixtures, and data on sampling, testing and inspecting materials used in asphaltic pavement construction. There is also a section describing the purposes of certain specifications for asphaltic cement. Other sections describe the relation of the defects of an asphalt pavement to its physical properties, the functions of various constituents of asphaltic pavement mixtures, and various phases of the work of construction, inspection and testing.

"EARTH, SAND-CLAY, AND GRAVEL ROADS," by Charles H. Moorefield, Senior Highway Engineer, Office of Public Roads and Rural Engineering, U. S. Department of Agriculture. Bulletin No. 463, U. S. Department of Agriculture, contribution from the Office of Public Roads and Rural Engineering; dated Feb. 21, 1917. Paper, 6x9 in.; 68 pp. and covers; illustrated.

This bulletin is a somewhat extended treatise on the location, design, construction and maintenance of the three kinds of roads named in the title. Its contents are divided into six parts as follows: Location and design, earth roads, sand-clay roads, gravel roads, road maintenance, specifications. The last section, included in the appendix, consists of a typical set of specifications, prepared by the Office of Public Roads and Rural Engineering for its own use. The illustrations consist of half-tone reproductions of photographs of earth, sand-clay and gravel roads, of construction work and of machinery. There are also included a number of drawings and diagrams showing cross-sections of roads and working drawings for the building of road drags.

EQUIPMENT — TRADE — MATERIALS

New Garford "Road Builder"

In order to meet the requirements of contractors and others using motor trucks in highway work the new Garford truck shown in the accompanying illustration has been put on the market.

The chassis is of standard Garford design with a wheel base of 128 in. The motor is of the 4-cylinder, heavy duty type and is placed in front of the driver's seat and within the cab, permitting the driver to make adjustments without leaving the cab. Power is transmitted from the motor to the jack-shaft by means of a worm drive and from the jack-shaft to the rear wheels through sprockets and chains. The differential is carried inside the worm gear. The machine has four speeds forward and one reverse, with direct drive on the fourth.

The body is of heavy steel construction, flanged at the top and reinforced with heavy gussets. It is supported on a frame of two longitudinal 4-in. I-beams connected by five 4-in. I-beam sills. It is 10 ft. long and 2 ft. deep. The width at the front and end is 6 ft. and at the rear end 6 ft. 6 in., to prevent the load from binding. The capacity is 5 cu. yd. The body is dumped by a hoist operated by hydraulic pressure and equipped with a device to automatically cut it out at the extreme dumping agle. The tail-gate opening can be regulated to spread material to any desired depth. All mechanism is controlled from the driver's seat.

All wheel bearings are of the Timken roller type of especially heavy design and can be adjusted to take up wear. Detachable center rims are supplied for the front wheels and herringbone cleats for the rear wheels. These cleats and the short wheel base are designed to facilitate operating under unfavorable conditions. The truck is regularly equipped with two drawbars, one of the double spring type for trailers and one of the rigid type for plows, scarifiers, graders and scrapers.

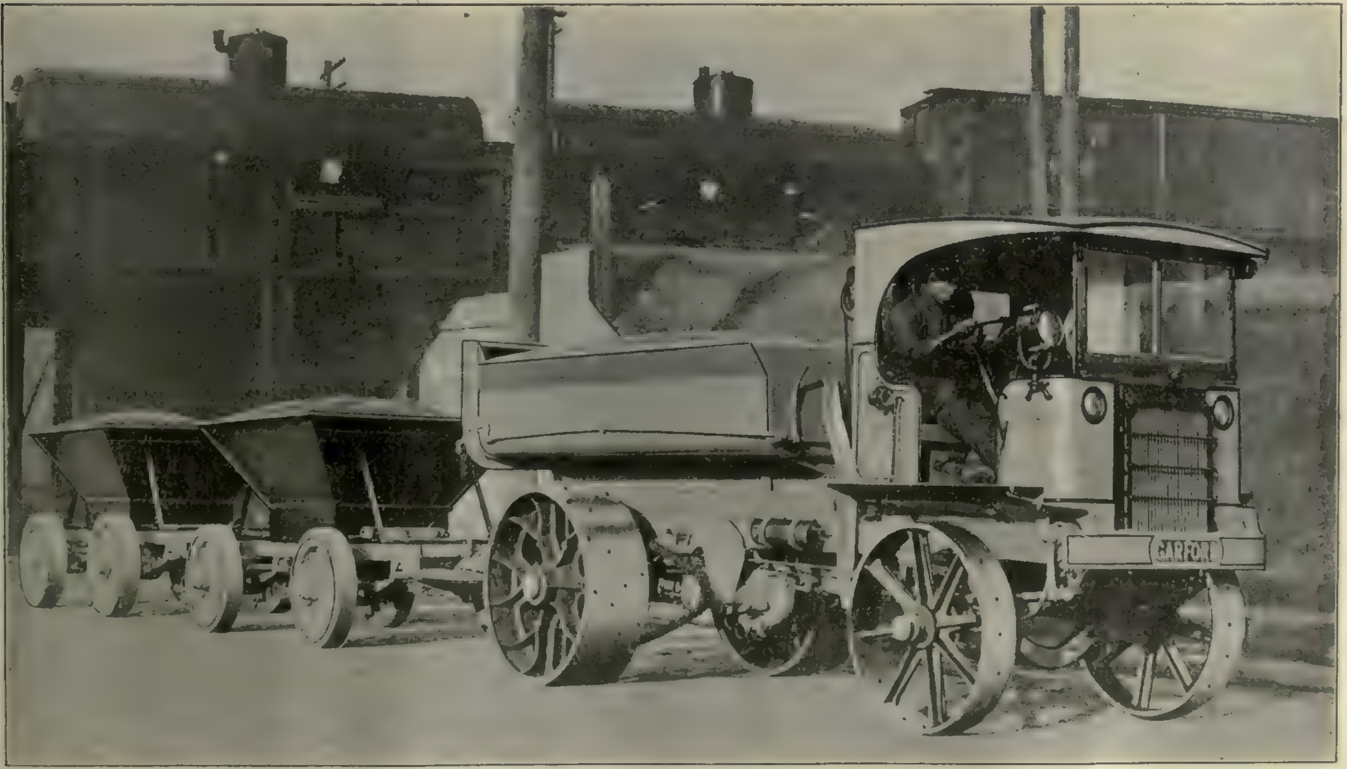
The "Garford Road Builder" as the truck is called, is built by the Garford Motor Truck Co., of Lima, Ohio.

Explosives Used for Earth Excavation in Winter Road Work

In a grade crossing elimination job at Mendenhall, Pa., the contractors have used explosives to advantage in loosening up frozen earth before excavation with steam shovels during the past winter.

The road on which the work was done curves through a cut, drops sharply to the railroad track, rises again and enters another cut. The cuts on both sides extend nearly to the track, and with the rather sharp curve and the presence of a large building near the track, which cuts off the view of approaching trains, made the crossing a constant source of danger. Several times serious accidents were avoided only by the quick action of automobile drivers.

Plans for the elimination of the crossing were prepared and a contract for the work awarded last winter. The plans called for the construction of a bridge 22 ft. above the tracks with a fill 22 ft. high and several hundred feet long on each end leading to a cut through the hill. When work was commenced on one of the cuts difficulty was experienced on account of the frozen ground and as a result explosives were employed to loosen up the material for the shovels. At first vertical holes, about 4 ft. apart, were driven by heavy punch bars and hammers until the bars broke through the frozen layer of soil, which varied from 14 to 18 in. in thickness. The holes were then loaded with 60% dynamite, ¼ lb. to a hole, and fired singly by means of caps and fuses. It was found that the holes were too far apart and that the dynamite was too quick acting for the work, its tendency being to break out



NEW GARFORD "ROAD BUILDER" HAULING TRAILERS.

GRADE CROSSING ELIMINATION AT MENDENHALL, PA. SHOWING FILL AT ONE SIDE OF TRACK.

MARION AND THEW SHOVELS AT WORK IN BANKS LOOSENED BY EXPLOSIVES AT MENDENHALL.

small craters without effectively breaking the crust. A slower acting, low freezing "farm powder" was then substituted for the dynamite and the spacing of the holes decreased to 3 ft. 6 in. At the same time the load was increased to ½ lb. per hole and the holes were fired simultaneously by electricity. This was found to give better results as it produced radial cracks extending from hole to hole, making it possible for the shovel to lift out material in large masses. It was found that after a small bench or face had been excavated better results could be obtained by using a soil auger to bore horizontal holes about 4 ft. deep and 4 ft. apart at the lower edge of the layer of frozen ground. A charge of ¾ lb. of "farm powder" per hole was used and the shots fired electrically. This method utilized the maximum heaving effect of the explosive, breaking the crust more thoroughly and permitting the shovel to work with greater efficiency.

The work was done by the Good Roads Construction of Wilmington, Del., with explosives manufactured by E. I. du Pont deNemours & Co., to whom we are indebted for the data herewith and the photographs from which the accompanying illustrations were made.

Motor Trucks Equipped With Snow Plows Used to Open City Streets

In the accompanying illustrations are shown some of the fleet of 5-ton White motor trucks used by the Bureau of Highways of Philadelphia last winter in snow removal work.

The front frames of the trucks are equipped with especially designed heavy steel plows which scrape the snow from the roadway and pile it along the side. The plows are 10 ft. long and 16 in. high and can be set at any angle. By means of an auxiliary steering wheel which can be seen in one of the illustrations the blade of the plow can be raised or lowered as desired.

The plows were used during last winter both in the city and in the suburbs.

Booklet on Concrete Curbs

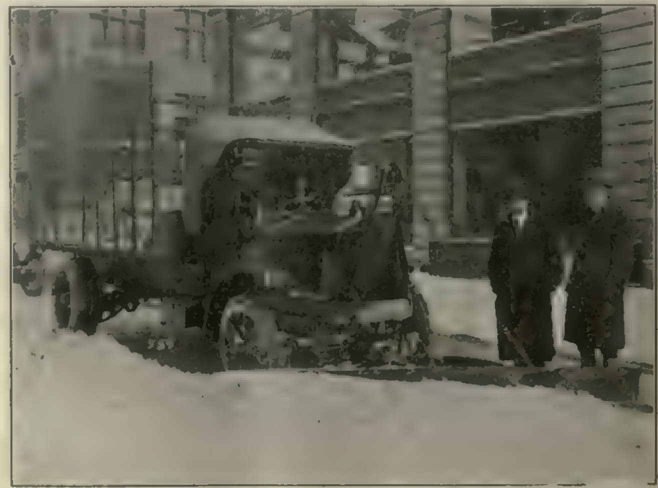
"Integral Curb for Concrete Pavement" is the title of a booklet recently issued by the Portland Cement Association describing the use and laying of integral curbs on concrete paved streets and roads.

The text of the booklet includes cost and construction data. The illustrations consist of half-tone reproductions of streets on which the curb has been laid, views of the work under construction, and detailed working drawings for two types of combined curb and gutter of concrete.

Duplex Truck Test

On a recent test a Duplex 4-wheeled drive truck hauled a 3½-ton load 10 mi. using only 2 gal. of gasoline, according to a recent statement. During the test the motor was run continuously although ten stops were made. The truck's record unloaded was 6 mi. per gal. The route was over icy and snow covered roads, no chains being used. The Duplex truck is manufactured by the Duplex Truck Co. of Lansing, Mich.

WHITE 5-TON TRUCK WITH SNOW PLOW IN OPERATION IN A PHILADELPHIA SUBURB.



WHITE TRUCK EQUIPPED WITH SNOW PLOW—VIEW SHOWING PLOW AND CONTROL.

GOOD ROADS

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NEW YORK, APRIL 21, 1917

Numbe
16

Unique Street Drainage Plan at San Diego, California

By A. C. FRANCIS*

A rather difficult problem of street drainage and paving has recently been solved in a novel way at San Diego, California.

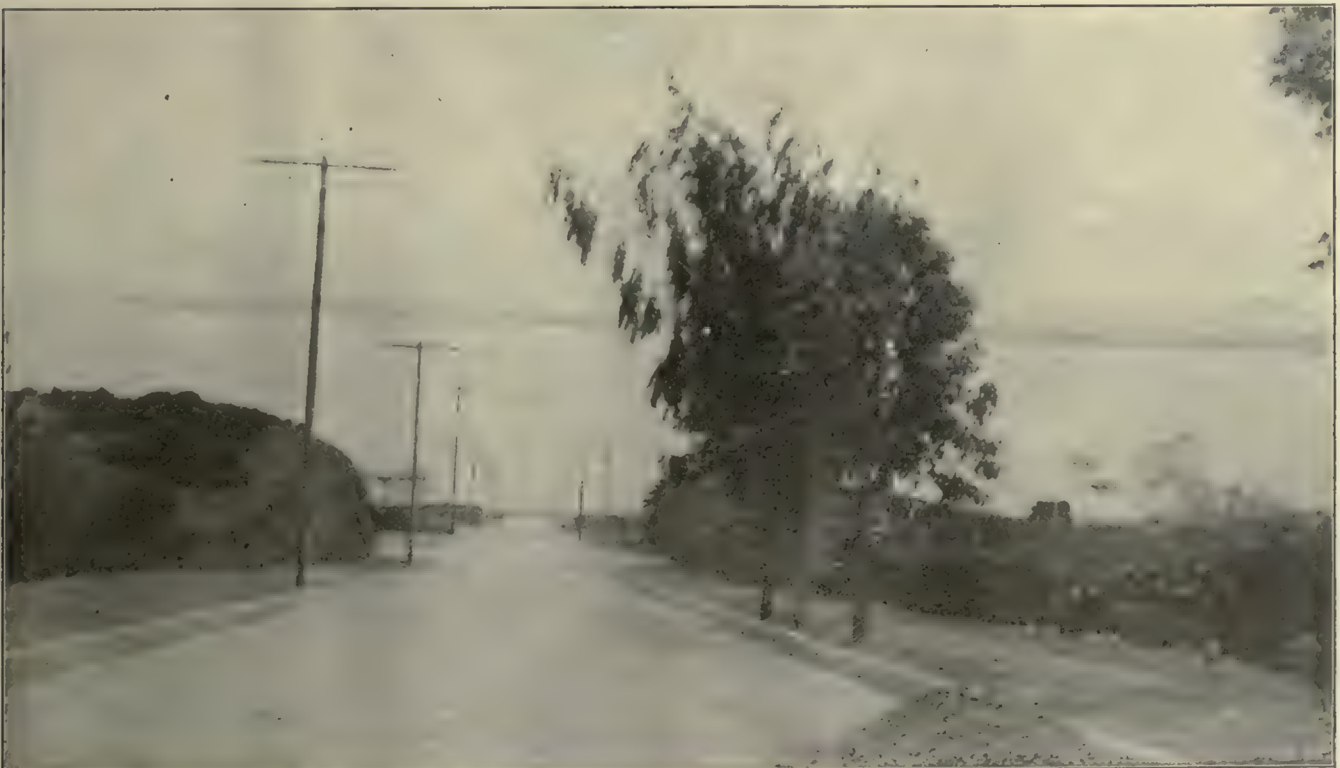
The work was done on the eastern slope of Point Loma, where, near the military reservation of Fort Rosecrans, houses have been built high up on the slope by a colony of wealthy residents. The location is one of much natural beauty and affords a view of the entire city of San Diego, San Diego Bay, and southerly over the Pacific Ocean. The soil of Point Loma is of such character, however, that one may throw a bucket of water upon the ground and see the earth melt away like sugar. The heavy rains of last winter washed enormous holes in some of the streets leading from the bay to the crest of the point, and after this experience the city engineer was called upon to devise a drainage system.

The main residence street runs parallel to the crest of the point and forms the terminus of the streets leading up from the bay. Under the plan finally adopted this street was not paved, but a 5-ft. concrete gutter was built on the upper side for a distance of four blocks. This construction is shown in one of the illustrations on page 240. The streets leading from this street to the bay are paved for a width of 25 ft. and a concrete sea wall built at the foot of each street. Cement concrete was used for pavements, which were laid to a depth of 4 in. and of a 1:2:4 mix, with transverse expansion joints every 30 ft. The paving was finished by floating, after tamping, to bring the mortar to the top.

The 5-ft. gutter on the upper street catches the water draining down from the cliffs above and discharges it on the paved streets leading down the hill, over which it runs to the bay.

The total cost of the work was $26,277.26. This included 14,442.8 sq. yd. of paving, $14,818.30 (not including grading); 10,537 lin. ft. of curb, $3,371.83; 1,119.4 sq. yd. of gutters, $1,108.25. The four sea walls at the foot of the hill cost $1,700.

A device developed by one of the city inspectors is used



CONCRETE PAVEMENT ON ONE OF THE STREETS LEADING DOWN THE EASTERN SLOPE OF POINT LOMA TO SAN DIEGO BAY—PAVEMENT CARRIES WATER FROM ABOVE

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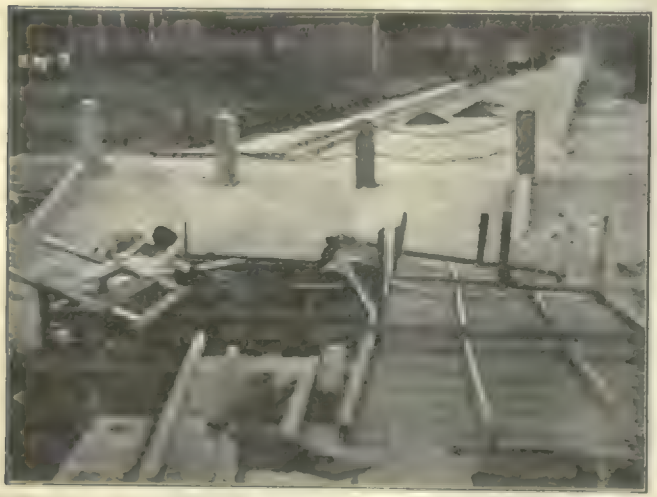
*Operating Department, city of San Diego, Cal.

5-FT. CONCRETE GUTTER ON HILLSIDE STREET THAT DISCHARGES TO PAVEMENTS ON THE STREETS UP THE SLOPE

for tamping the fresh concrete on narrow streets such as those paved on this job. It consists of a templet or strike-board built of 2x12-in. planks, placed side by side, giving a 4-in. striking surface, and shod with steel to prevent wear. A sufficient number of planks are spliced together to reach over the entire width of the street, and the lower edge is then shaped to conform to the crown of the pavement. The planks are then bolted together, the lower edge protected by ⅛ in. of steel, and the whole braced with a truss at the top. Plow handles are fitted to each end for the use of the men in handling. After the wet concrete has been tamped with this strike-board it is finished by wooden floats operated by men working on a plank bridge over the pavement.

Road Legislation in Massachusetts

In the report submitted to the Massachusetts legislature by the special commission for the revision and codification of the highways laws of the state several important changes in the highway laws are suggested. This commission was established by the 1915 legislature and consists of the members of the Massachusetts Highway Commission, William D. Sohier, F. D. Kemp and James W. Synan and four others appointed by the governor with the advice and consent of the council. These other members are Moody Kimball, Warren Goodale, John E. Swift and Charles C. Spellman. The original resolve called for a report at the 1916 session of the legislature, but at that time the commission was continued and directed to report to the 1917 legislature.



SEAWALL AND STEPS AT THE FOOT OF ONE OF THE CONCRETE PAVED STREETS USED TO CARRY WATER DOWN THE SLOPE TO POINT LOMA.

Among the more important recommendations are that there be enacted "An act to secure more uniform control over town ways" and "An act relative to the accounting in highway departments of towns."

Under the existing statutes, according to the report, various methods of electing or appointing highway officials obtain in different towns. These methods include the election or appointment of a highway surveyor or surveyors, the election of a road commissioner or commissioners and the election or appointment of superintendents of streets or other officials. The proposed law provides that in towns of less than $5,000,000 valuation the selectmen shall have control of all highways and bridges, except those under the supervision of the Massachusetts Highway Commission or the county commissions, and that superintendents of streets shall be appointed subject to the approval of the Massachusetts Highway Commission to have direct charge of the work.

In regard to the present methods of accounting the report states that at present the taxpayers of many towns are unable to ascertain "where and for what purpose their money has been spent." To remedy this condition the proposed law directs that the selectmen or road commission "shall adopt a uniform system of accounting in connection with all highway work performed within the town, which system shall be prepared by the Massachusetts State Highway Commission and furnished by the selectmen to the superintendents of streets, and which shall contain a detailed statement of all receipts and expenditures for the outlay, construction, repair and labor of all streets, ways, bridges and sidewalks within said town."

The 1917 legislature, which has not yet adjourned, has passed a law (Chapter 67) assenting to the federal aid law passed in July of last year and authorizing the Massachusetts Highway Commission to cooperate in all necessary ways with the federal government in the construction of roads under that act.

Road and Bridge Expenditures in Iowa During 1916*

Iowa during 1916 spent $14,337,056 on her roads and bridges. Roads, county and township, took a combined total of $7,164,810. Bridges and culverts, together, cost her $7,436 more, or $7,172,246.

Of these sums 40%, or slightly less than one-half of the county road money, went for what may be reasonably classed as permanent work. Of the bridge money 59.3%, or nearly two-thirds, went for bridge work classed under state specifications as permanent.

Total road and bridge expenditures for 1916 show an increase of $811,439 over those of 1915 and $2,736,056 over those of 1914. However, this point must be borne in mind, that figures for 1914, while the best and most accurate compilations of road and bridge cost data ever collected in Iowa up to that time, were far from complete. Figures for 1915 were far more complete, due to greater accuracy and more complete returns by county engineers. Figures for 1916, however, due to still greater experience on the part of engineers, more carefully prepared blank forms and more persistent effort on the part of the checkers and tabulators in securing important information omitted in the reports as originally turned in by the county engineers, are without question the most complete and accurate record of road and bridge expenditures ever compiled in Iowa. It is doubtful if any state in the Union knows with anything like equal certainty so nearly just what road and bridge construction is costing as does the Hawkeye state. Iowa knows today, with reasonable accuracy, just what her roads and bridges are costing her.

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*From the Iowa "Service Bulletin."

The Contract and Specifications for Paving*

By C. A. MULLEN†

It is only necessary to look at the contract and specification forms in use by our many city, county, state and provincial road departments to realize that the importance of this subject either has not been fully grasped, or, if understood, has been sadly neglected. For my part, though I have had occasion to examine and study many paving contracts and specifications, I have never found even one that seemed to be a finished product, or, in fact, any more than the throwing together of many more or less disconnected sentences and paragraphs. When it has fallen to my lot to prepare such documents, I am free to confess that I have added but little or nothing to the art, and that I am no more pleased with my own products than with those of my contemporaries.

Some one has aptly remarked that a short contract makes a long lawsuit. It may well be added that a poorly drawn contract makes a long lawsuit still longer. I do not know that anyone has ever estimated the cost per square yard of the many litigations growing out of road and street paving work, but certainly this can be no inconsiderable amount. To the judgments and law costs paid directly by public bodies must be added that part of a contractor's contingency figure included in his bid price to cover probable legal expenses. It may be truly said that, no matter which side wins the lawsuit growing out of a paving contract, the public always loses. If it wins the suit it loses possibly not so much; but it should be remembered that the contractor's losses and expenses always go to make up other contingency items. Therefore, it behooves those intrusted with the design and construction of public road work to do all in their power to reduce the possible causes of such lawsuits.

The relations between the road department and the paving contractor are no different than those existing between any other buyer and seller. Their interests are diametrically opposed. The main reason a contractor builds a road is for the profit there is in it. With him, use is a secondary matter, in which, if he is in the better class of his calling, he is mildly interested. Where road paving is done on a strictly competitive basis, no matter how high a contractor's ideals may be or how much secondary pleasure he might be able to get out of doing a good piece of work, the least that the road department can be induced to accept is the most that any contractor can afford to give. After all, the standard of road construction in any community is not so much the letter of the contract as the interpretation of it that the road authorities are accustomed to permit in actual practice. Well drawn contract and specifications are a prime necessity, of course, but with them competent supervision and careful inspection are also indispensable to good results.

Nothing in the foregoing paragraph is intended in any way as an aspersion upon contractors. As fine men may be found among them as in any other walk of life. They are quite as human as other people, and equally governed by their practical necessities. In justice to him and to the public alike, a better understanding between the contractor and the road department is essential if we are to get the best results obtainable through the contract system. Being in many respects the under dog, the contractor will, in nearly every case, be found ready and anxious to cooperate in matters that promise to bring about that better understanding. Fully realizing that the basis of their relations to the road departments is the contract they sign and the specification for the work that accompanies it, any forward step looking to the improvement of these documents by making them more practical and definite will meet with very general support from at least the better element in the road building fraternity. These men will also be found quite ready to submit to the most rigid systems of direction and inspection, provided the work is carried out in a common sense way, and provided that it is known in advance of the bidding that even-handed justice will be dealt out to all parties alike.

In the first place, the contract should be in the nature of an agreement between equals, one of whom is ready and willing to deliver the goods specified, the other ready and willing to pay the price stipulated. Many—in fact, most—of the paving contracts that I have examined, and some that I have been bound by, more nearly resemble a master-and-slave contract. The engineer, especially if he is a man of superficial understanding, always poses as master to the constructor's slave. Since freedom of contract is very largely a legal fiction, one should not be surprised to learn that, as soon as they have signed such one-sided documents, most contractors have the feeling that anything they can get away with is theirs. Some engineers—and I have one in mind who rode on my neck for several unpleasant months—do not even admit that their interpretation of the contract must necessarily be reasonable. The contractor, especially if he is a man of small finances, must often grin and bear this attitude of the engineer, denying himself even the luxury of telling the man what he thinks of him until the work is completed and the money collected.

Now such a condition of affairs is not conducive to the best results in road building. No matter how clever an engineer may think himself, the contractor who feels that he is being badly used can deliver and collect for a job that is much less than the best that is possible under the agreement, even though he save no money to himself thereby. Inversely, an engineer who is ill-disposed to the contractor working under him can always cause more expense than is actually required to do the work properly, especially if such engineer is armed with the too common poorly drawn specification coupled to the master-and-slave form of contract. While it is true that the interest of the contractor and the interests represented by the engineer are opposed in the major premise, there is no reason why both parties should not candidly recognize this fact and then go ahead, with the least friction possible, in the building of a good road. One of the prime necessities of team work between engineer and contractor is that each thoroughly understand and respect the rights of the other. As a basis for this, there must be the well drawn and easily understood contract and specification in which what each party has agreed to do is clearly stated. Enough unforeseen details will then crop up, during the progress of the work, to call for the exercise of good sense and a sweet temper between even well disposed men.

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In many contracts it is stated that certain things must be done when the engineer has no intention at all of demanding them, and other things are expressly prohibited that in practice the engineer will quite properly permit. Such a contract is not fair to the contractor. What is necessary should be stated; what is not necessary should be omitted. The requirement for planking a concrete foundation to haul upon it after it has been down seven days is such an instance. Few engineers enforce this clause; and if one did I should be very suspicious of the quality of his concrete.

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*Extracts from a paper presented at the Fourth Canadian and International Good Roads Congress, Ottawa, Ont., April 10-14, 1917.

†Director, Paving Department, the Milton Hersey Co., Ltd., Montreal, P. Q.

Any pavement foundation that has set seven days and will not then carry without risk the hauling incident to further construction is not fit to accept. Planking grade is also frequently required in the contract when it is unnecessary and not demanded in practice—unless, perchance, the engineer wishes to punish his "slave." Can one blame the slave if, in order to get even with his "master," he stays awake nights devising a scheme by which he can use two bags of cement instead of three under his master's very nose? This is being done every day; but sad to relate, it is the public and not the engineer that sustains the loss.

In drawing the specification the rule should be: A reason for everything, and everything in its place. Can engineers much longer go on specifying things that they do not understand? The unfortunate attitude of many public bodies in thinking that, because they have hired a man who is a graduate engineer, he should be able to solve every problem submitted to him, without special assistance, is the cause of more poorly drawn specifications than anything else. I have sometimes noticed that the smaller the salary an engineer receives the more he is expected to know. The poorly paid village engineer, who is expected to know it all, and is thought to be too expensive even at that, finds himself compelled to get along as best he can alone in order to hold his livelihood. The result is a brave attempt at a specification that is taken in chunks from standard and other specifications and through which, when it comes to a lawsuit, the contractor and his attorneys can drive a team of horses at almost any point. It is all that could have been expected from the engineer under the circumstances. Family doctors are not expected to perform appendix operations, and those who require it of them must expect to suffer in the process of cutting.

As paving engineers, why do we ask a contractor to guarantee the work that we design, direct and inspect? We tell the contractor what to do, how to do it, and when. If the pavement goes wrong—barring absolute fraud, of course —why should the contractor pay the penalty? Fair play demands that the engineer guarantee his own road. I do not mean to actually suggest that he be asked to give a bond and make good the loss, but that the contractor should not be required to make good a failure if it is in no way his fault. The engineer's reputation should suffer, not the contractor's pocket, and through him the public's. If this rule held true, engineers would be much more careful in the paving work that they specified and constructed. I have noticed that the contracts which leave the contractor with the least to say about how the work shall be actually done also frequently bind him the tightest with a guarantee for the result. This is an element of chance that is forced upon the contractor; and, as with everything else, he, of course, figures on it in his bid.

New Highway Officials in Kansas

In accordance with the provisions of the new highway law of Kansas, a review of which was printed in the issue of March 31, Governor Capper has named as the two appointive members of the State Highway Commission, E. R. Moses, of Great Bend, and R. S. Tiernan, of Fort Scott. Brief mention of these appointments was made in personal notes in last week's issue. The Governor is ex officio chairman of the commission.

On the 3d of this month the commission met and organized, and on the 4th appointed W. S. Gearhart State Highway Engineer. W. C. Markham was appointed Secretary. Mr. Gearhart, who has had charge of highway work in Kansas since September, 1909, has resigned his former position with the Agricultural College at Manhattan.

Width and Length of Road to Build*

By EDWARD ST. C. SMITH†

In almost every road building project there arises the question of width of pavement. It is referred to here because it affects very materially the cost of construction and maintenance. It is a question largely of the amount and character of the traffic. Practice has demonstrated that the total width between ditches should not be less than 24 ft. regardless of the width to be paved except in the case of steep hillside locations. Whether a single or double track road is to be built depends upon the traffic to be anticipated. Unless a pavement is at least 16 ft. wide, the traffic will cling persistently to the center of the road. The only thing that will force it from there is more traffic. A road carrying heavy traffic should be wide enough and have a crown light enough to encourage the use of the entire width of the pavement. Only in this way can the life of the surface be increased, the maintenance cost reduced and the road operated at its highest efficiency. It should be borne in mind that while a double track road costs proportionately more than a single track road the maintenance cost per square yard of the former is much less for the same volume of traffic.

General practice seems to have adopted a width of 9 or 10 ft. for single track and 15 to 18 ft. for double track pavements. Widths of 12 and 14 ft. have been tried out, but experience seems to show that unless an ample double track width is provided, a strictly single track road had better be built, because only the more liberal widths will be regarded as double track roads and the traffic will stay in the middle. In the case of a 12-ft. road the extra 3 ft. increases the cost one-third and is not used except when vehicles are passing each other. The best practice seems to indicate that a road should either be wide enough to permit two ordinary vehicles to pass with safety, or else be strictly a single track road. In the case of roads to be built in very hilly or mountainous country where the cost of a double track road would be prohibitive, it would be better to construct a single track road with turn-outs and other necessary safety features, with a view of widening it at some future date when conditions warranted the extra expense.

So far we have assumed that there is sufficient money available to build the type of road required. Suppose now the funds are so limited that the higher types of roads cannot be considered. It is desired to improve a certain mileage of roads and there is not sufficient money immediately available for first-class improvement throughout. How can the available money be spent to best advantage for the general good of the community? Two plans are possible: (1) Select one main road and improve it in first-class condition as far as the money will go; then stop until more money is available; or, (2) select a larger mileage and spend the money in general improvement, such as improved location, grading and drainage. In the writer's opinion, the greatest good to the greatest number will be made possible under the latter plan, namely, a general improvement of the permanent features of a road as above enumerated. I am aware that some road builders and promoters will disagree with me on this point. Some will say: "Build a good road or build none," with which slogan I heartily agree, but I am not in favor of spending all of the money available on the first mile of, say, a 20-mi. stretch, then dumping the traffic off into the mud for the remaining 19 mi., if it is possible to so grade and drain the entire stretch as to make travel over it a pleasure all of the way.

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*Extract from an address at the 1917 session of the West Virginia State Road School.

†Supervising Engineer, Piedmont District Road Improvement. Mineral County, W. Va.

Good Roads and Land Development

By **THOMAS ADAMS**†

Economic and other practical questions in connection with good roads are not confined to matters relating to construction. While a great deal of money can be lost by extravagance in paving, by using the wrong materials and by want of employing engineering advice in making roads, yet, although the fact is not quite appreciated, the direct and indirect loss due to bad planning of roads can be, and probably is, much greater than that which may be due to unscientific construction. Bad planning of a highway system has the effect of increasing costs due to haulage up steep grades and over greater length than is necessary; it causes roads to be laid over hills and across muskegs, creating difficulties in connection with land development and drainage of the worst kind; it has the effect of scattering the population so that the amount of road surface to be made is entirely out of proportion to that which can be paid for out of any reasonable tax on the people or on the land served by the roads. For the latter reason it causes local authorities to leave roads unmade or to accept the most primitive forms of construction.

Roads should be designed by engineers to save waste in road space as well as in road construction. Above all else our highway policy should be designed to secure the principle of the maximum of convenience at the minimum of expenditure.

When road questions are discussed it is too frequently assumed that it only requires courage and willingness on the part of public administrators to secure a good road system. As a matter of fact, there is scarcely anything in regard to which more courage and willingness are shown, and the real trouble is not the want of public spirit, but simply the want of the available cash to construct roads according to our expensive and wasteful system of planning them. As a matter of fact we do not plan them; we fit them somehow into a system of rectangular sub-division —either along the concession lines or on a 5% basis, which is little better. We should learn to plan our roads for a purpose. There are a few people in favor of good roads because they want to enjoy motoring in the country, and a few others who do so because they want to sell road materials or machinery; but the public opinion in favor of good roads, which really counts, is that which looks to that means to help in developing the resources of the country. These people want to know how much value the good roads are to the farm, to the factory, to the home; and they are not going to pay more than they are worth, no matter how much those who want them from other motives may argue in their favor. Roads are primarily for the purposes of providing access to property, means of developing land, and means of communication for carrying on our industries.

Our roads in Canada are of too great a length, too great a width, and there are too many of them in proportion to the taxpaying capacity of the people, outside of the most thickly populated parts of the country.

Even in the United States, with their greater density of population and with their progressive road policy, they are only able to get satisfactory roads in rural districts by transferring too great a burden of construction to posterity, and then they only get one mile in ten constructed in a satisfactory manner.

According to Mr. Nelson P. Lewis, Chief Engineer of the Board of Estimate and Apportionment of New York City, "The State of New York, by the vote of its people, has authorized the expenditure of $100,000,000 for the improvement of the state highways, and this enormous sum is raised by the issue of 50-year bonds. While a portion of the work to be done is undoubtedly of a permanent character, such as the widening and straightening of the roads, the improvement of grades and provision for drainage by substantial structures of masonry or steel, a very large proportion of the expenditure is for road surfaces, many of which can scarcely be expected to last for more than ten years. Borrowing money for 50 years to pay for ten-year roads is obviously unwise."

The only sound principle in financing road improvements is to pay for all construction over the period during which it lasts, and to borrow money for any longer period, say up to 50 years, only in respect of such portion of the work as is permanent. This permanent portion consists of the matters which may be described as incidental to the planning of the roads, such as improving the grades by excavation and filling, acquiring a comprehensive survey of every part of a road system before large expenditure is incurred.

Comparisons are sometimes made between the good roads of the British Isles and the poor country roads of this continent. It is only during the last 100 years that the roads in Britain have become satisfactory, and the greater part of the cost of improvement has been borne during the last 25 years. In the eighteenth century the roads in England were hardly passable. We are told that the old Romans used to travel over their highways in southrn Europe at the rate of 100 mi. a day, but that in 1703 it took Prince George of Denmark 14 hours to travel 40 mi. from Windsor to Petworth. So conservative were the masses of people in Britain against having good roads that in the eighteenth century they resisted their construction with riot and bloodshed, and even when the roads were made and improved country people in many districts refused to use them. Today it is recognized in Britain that the best means of promoting agriculture and the proper development of the land is to have good roads. But the system has to be built up on an economic basis. Those who advise the large landowners in England consider that there is no better investment than the making of good substantial roads, and that intensive farming cannot be carried on without them; but they only make the roads that are absolutely necessary and do not make reservations round the farms, as if by merely making the reservations they ipso facto created roads. Unfortunately in Canada we have had no proper plan of our road system prepared; the rectangular layout of land is entirely meaningless from any other purpose than that of securing accurate measurement of the land, for which purpose it is well adapted.

Human necessity, the traffic requirements of the whole population and the relative cost of development to the value of the land and other property developed should be the guiding principles in laying out a system of roads and streets. Considering the enormous expenditures required to be incurred to improve roads, their economic and social value, the importance of directness of route, the danger and inconvenience of sharp curves and the advantage of easy grades, it is extraordinary that our stereotyped rectangular system pays no respect to either of these questions, except in so far as it does so by accident. The money that is spent by highway departments has to be allocated without the engineer having any voice in the location of the roads or in their original plan. Even with all the knowledge we have on this subject we split highway administration between colonization departments and ministers of highways so that our highway departments have to finance a system which they have not designed. As a concrete instance of the saving which can be effected in planning a single piece of road the "Municipal Journal" of America draws attention to a road at Cape Cod, Mass., where the estimate of cost varied from $14,000 to $36,000. The layman, without the assistance of the engineer, guessed within 61% of the actual cost, the engineer, without special examination, guessed within 39%, and after a proper study he arrived at approximately the true cost. What, however, is really more important is that he reduced the cost by 25% by planning a more economical location.

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*Paper presented at the Fourth Canadian and International Good Roads Congress, Ottawa, Ont., April 10-14, 1917.

†Town Planning Adviser, Ontario Commission of Conservation.

The moral in this is not only that preliminary plans of roads should be made by competent engineers in the interests of economy, but that the engineer should have the power to exercise discretion as regards location of the road.

As the County Roads Board in Australia said in their report of 1914, "Badly located and badly laid roads are a constant tax on any community." No matter what the construction they increase the cost to maintain and determine the amount of load to be carried. We all recognize that well planned and well made roads would help to build up manufacturing industries, cheapen production and reduce the cost of living by bringing the farmer nearer the consumer. Incidentally it would make it easier for the motorist to get about the country, but he is only a secondary consideration. Good roads would also attract settlers to areas that must remain unsettled without them. But in order to get good roads within the paying capacity of the people we will have to be less extravagant in regard to the width of all secondary roads; and in order to be more liberal in regard to width of the main thoroughfares we will have to be less wasteful in regard to second and third class roads and streets. We simply cannot raise the money to make our present road and street system efficient, and the 66 ft. minimum in this province is an economic absurdity. When we lay out roads we should do so on a practical basis.

Roads should be planned, designed and constructed, as a rule, to suit the particular form of land development to be served by them. They should be made with due regard to the best use to which the land can be put. Provincial aid should be confined to improving the principal lines of communication. The system of planning highways in country districts determines the street system of the city; but we do not attempt in designing the one to consider its effect on the other.

The actual cost of a street 66 ft. wide, including a 9-in. sewer, a street pavement of asphalt on concrete foundation 28 ft. wide, two cement sidewalks each 5 ft. wide and 28 ft. of boulevard in Ottawa in 1916 was $27.50 lin. ft. Thus for a 25-ft. lot the cost of local improvements alone amounts to $343.75. If the cost of land is added it means that $700 to $1,000 has to be paid by the working man for a properly improved lot in a city area.

Owing to their more economical method of planning, widths of streets and frontages of lots, in England, e. g., a working man can obtain a site for a home, including local improvements, on a street 36 ft. wide for $214 as against $725 in a similar location in Canada. Allowing for the difference in the value of the dollar in both countries, the cost is even then from two to three times as much in Canada.

Narrow minor streets, in residential and rural areas, enable wide thoroughfares to be secured where they are wanted; they enable more air space to be given to the buildings, although one of the reasons for making a wide minimum is for the purpose of giving the buildings air space in the street instead of from the space reserved on the lot; they enable a highway system to be developed on the only sound basis, namely, that the cost of building up the system shall not exceed the ability of the people served by it to pay for it. But there is no particular virtue in the wide street or the narrow street—the only virtue is in planning all streets to adapt them for the purpose they can best serve in connection with the development of land, and above all with due regard to the economic relationship between the value of the land and other property they serve, and the cost of the road or street. Excessively wide streets cause overcrowding—although they are designed to prevent it.

Until we have a properly planned system of highways adapted for all purposes, and economically sound, we will not be able to deal effectively with bad land development in town and country, and we will only be able to go on dealing with the improvement of roads in a sporadic and haphazard manner—good enough in its way and a satisfactory advance on the past, but far short of the ideal which we should seek to attain, and costly and wasteful in the extreme.

The want of a properly designed system of highways is one of the chief causes of the social isolation in rural districts, of lack of cooperation and of development of rural industrials. It is more correct to say that rural prosperity and increased production depend on a sound economic system of road planning than to say that those things depend on good road construction, for the simple reason that good road construction can only be widely applied if we alter our system of planning.

New State Highway Engineer in Oregon

Herbert Nunn, at one time City Engineer of El Paso, Texas, and later in charge of road work in Multnomah County, Oregon, was elected State Highway Engineer of Orgeon at a meeting of the State Highway Commission, held at Salem on April 10. Mr. Nunn will receive a salary of $3,600 a year.

Indiana Highway Commission Appointed

The appointment of members of the State Highway Commission, created by an act of the 1917 legislature, was recently made by the Governor of Indiana as follows:

David C. Jenkins, Kokomo; L. H. Wright, Columbus; S. W. Taylor, Boonville; Haines Egbert, Goshen.

A brief resume of the new Indiana law was printed in "Good Roads" for April 7.

New Legislation in Vermont

At the recent session of the legislature of Vermont, which adjourned on the 12th inst., some new legislation affecting road building in the state was passed. One law provides that the state shall give assistance to towns on unselected roads—that is, on roads that are not state aid roads. A fund of $50,000 was set apart for this purpose. The work contemplated under this fund is of a somewhat permanent character, but not on so large a scale as regular state work.

The state aid bridge law was enlarged in its scope so that towns will receive one-third of the cost of each bridge, but not to exceed $400 in any one case. This law refers to bridges on state aid roads, which must be between 4 and 30 ft. in span, but engineering assistance is given on all bridges on state aid roads, whatever the span.

A law was passed giving the State Highway Commissioner full authority to take advantage of the federal aid road act and to cooperate fully with the federal government.

The office of State Engineer was created at this session. The incumbent of this office will have charge of all the engineering problems of the state departments, except such as the district highway commissioners of the State Highway Department are able to handle for themselves. His work in connection with the highway department will be done under the direction of that department.

The New Highway Law of New Jersey

As was noted in a previous issue of "Good Roads" ["Fifteen Million Dollar Road Bill Passed in New Jersey," "Good Roads," March 17, 1917, page 178] the highway laws of New Jersey have been materially changed by the passage of several bills at the 1917 session of the legislature. These new laws are contained in chapters 14, 15, 16 and 98. Chapter 14 is "an act to estabish a state highway system and to provide for the improvement, betterment, reconstruction, resurfacing, maintenance, repair and regulation of the use thereof." Chapter 15 is "an act to establish a state highway department and to define its powers and duties; and vesting therein all the powers and duties now devolved by law upon the Commissioner of Public Roads, and the existing State Highway Commission and Highway Commission." Chapter 16 is "an act to provide for the taxation of real and personal property in this state for state road purposes." Chapter 98 is "an act to create the office of State Engineer and to define the duties thereof and provide compensaion therefor."

Chapter 14 establishes a system of state highway routes, 15 in number, traversing the state from north to south and from east to west. It is provided that existing highways may be included in these routes whenever it is convenient to do so, but that the commission may lay out, open and improve new roads over acquired rights of way.

The state highway commission is empowered to take over as state highways any roads or parts of roads. Certain provisos in connection with this make it incumbent upon the state to assume any contractual or agreement rights previously assumed by the governing body having jurisdiction over the roads, to suspend operation under the act until the completion of any contract which may have been awarded previous to the taking over of the road by the state, and to reimburse any county for work done on the road under a contract awarded after March 1, 1916.

Roads becoming state highways under the act must be paved with "granite, asphalt or wood blocks, bricks, concrete, bituminous concrete, sheet asphalt or other pavement having a hard surface and of a durable character." However, in the maintenance of highways improved with other materials from these the commission may use the material of which the roads are constructed pending their repaving with the materials prescribed by the act. In improving state roads all pavements must be at least 18 ft. wide, and all roadways at least 30 ft. wide. It is also provided that "all sharp turns and angles and railroad grade crossings shall be eliminated wherever practicable."

The law provides that the state highway commission shall take charge of all work on state highways and that all work of improvement, betterment, reconstruction or resurfacing shall be done in accordance with plans or specifications prepared by the state highway department. All work of maintenance, repair and extraordinary repair must be done at the expense of the state and may be carried out either by contract or force account. All construction work and all extensive repairs to improved roads taken over as state highway must be done by contract or by the inmates of state institutions. In construction, repair or maintenance work on roads included in the state highway system the commission is given all powers "not incompatible with its functions nor prohibited by law" that are exercised by overseers of roads and boards of freeholders in road construction, repair and maintenance.

No franchise, grant or consent for the occupation by public utilities of any portion of a road included in the state highway system may be given prior to its being taken over as a state highway except under such conditions as may be approved by the state highway commission. No state highway may extend into a municipality other than a township having a population of over 12,000. It is also provided that with such a municipality, in which the streets or roads form connections with state highways, the state highway commission must enter into contracts for work "which shall place such streets or roads in a condition that will be in keeping with the nature of the state highways approaching and leaving such municipality."

The law provides that the state highway commission may lawfully enter into agreement with any board of chosen freeholders or other public body, or any person or corporation, to cooperate in any work and to assume any portion of the cost of such work.

Chapter 15 provides for the establishment of a highway department to be governed by a board of eight members known as the state highway commission. Two of the commissioners must be "qualified and competent engineers," and all of them must be residents of the state. The governor is ex officio a member of the commission. The law provides that the eight members shall be appointed by the governor, by and with the advice and consent of the senate, two for one year, two for two years, two for three years, and two for four years, and that annually thereafter two members shall be appointed each year for a four-year term. The governor is given power to summarily remove any or all of the members of the commission. The commissioners are allowed no compensation for their services, but their expenses are to be paid by the state. The law directs the commission to organize each year by the selection of a chairman and the appointment of a secretary. The latter must be an employee of the state highway department. The board must hold not less than twelve meetings each year, all of which must be open to the public.

The law provides that the commission shall elect as state highway engineer, a person "who shall be a qualified and competent engineer, who has had actual experience in road and bridge construction and maintenance." He is to hold office for a term of five years and must devote his entire time to his duties. His salary is fixed by the board and he receives reimbursement for his necessary expenses. The law also provides that the board shall elect an assistant state highway engineer whose qualificatious shall be the same as the state highway engineer's and whose salary shall also be fixed by the board. He holds office for five years and is allowed his necessary expenses. The power to summarily remove the state highway engineer or the assistant state highway engineer for cause, after a hearing, is vested in the commission.

The board is also empowered to appoint and employ such other assistants as are necessary, and to fix their duties and compensations. All these appointments, except those of the state highway engineer and assistant state highway engineer, must be within the civil service of the state. The power to engage employees and to fix their wages and duties may be delegated by the state highway commission to the state highway engineer or to the assistant state highway engineer.

The powers and duties of the state highway department are defined by law as those exercised by the state commissioner of public roads under the law which it supersedes. All actions of the state highway commission must be determined by a vote of the majority, the governor being empowered to cast the deciding vote in case of a tie.

The law further provides that in addition to, and not in limitation of its general powers, the state highway commission shall have power:

a. To determine and adopt rules, regulations and specifications and to enter into contract covering all matters and things incident to the acquisition, construction, reconstruction, maintenance and repair of state highways.

b. To execute and perform as an independent contractor or through contracts made in the name of the State of New

Jersey, all manner of work incident to the maintenance and repair of state highways.

c. To establish and maintain as an independent contractor or employer a patrol repair system for the proper and efficient maintenance and repair of state highways.

d. To employ and discharge, subject to the provisions of the civil service act, all foremen and laborers, prescribe their qualifications and furnish all equipment, tools and material necesary for such patrol repair system.

e. To widen, straighten and regrade any state highway and to acquire any lands or rights therein by gift, device, purchase or condemnation, according to the procedure as contained in an act entitled "An act to regulate the ascertainment and payment of compensation for property condemned or taken for public use" (Revision of 1900), approved March 20, 1900, and vacate any state highway or any part thereof.

To do and perform whatever may be necessary or desirable to effectuate the object and purposes of this act.

To do and perform all acts now required by any law to be done and performed by the state commissioner of public roads, the state highway commission or the highway commission. These powers are to be liberally construed.

According to the law, the funds provided to meet road expenditures, as required under the act or other acts, shall constitute a state road fund which shall include "the appropriations made therefor by the legislature, the receipts from motor vehicle licenses and from fines for violations of Chapter 113, Laws of 1906, its amendments and supplements, as therein provided, and from any state tax levied for that purpose; from federal aid and other contribution, sales of condemned property, fines, penalties, or damages for violation of any law providing for the protection of roads." An amount equal to the state road tax must be expended for the extension and construction of state highways. The remainder of the state road fund may be expended for state aid to counties and municipalities, as provided by law, and for the maintenance and administration of the state highway department, provided that no funds may be expended for state aid unless the roads built therewith conform to standards prescribed by the state highway department and unless the county or municipality shall agree with the state highway department to keep such roads in repair by patrol or such other methods as may be adopted by the department.

The law provides that the term of office of the state commissioner of public roads, of the members of the state highway commisison and of the members of the highway commission shall terminate 30 days from the date the act takes effect.

[The act was approved March 13, 1917, and took effect immediately.]

Chapter 16, providing for a tax for state road purposes, is in part as follows:

1. There shall be annually, for a period of five years from the date of the passage of this act, assessed, levied and collected in each of the municipalities of the counties of this state, a tax of one mill on each dollar of the value of all the real and personal property in every such municipality upon which municipal taxes are or shall be assessed, levied and collected. Such tax shall be assessed, levied and collected in the same manner and at the same time as other taxes upon real and personal property are now assessed, levied and collected. It shall be the duty of the collector or other officer having the custody of the collected taxes, on or before the twenty-second day of December in each year, out of the first moneys collected, to pay to the county collector of the county such state tax required to be assessed in his taxing district, and the county collector shall pay the said state tax, which he shall have so received from the taxing districts, to the treasurer of the state on or before the twentieth of the next January, and the said state treasurer shall place the same in the state road fund.

Chapter 98, creating the office of state engineer, is as follows:

1. There is hereby created the office of state engineer.

2. The duties of the state engineer shall be:

A. To act as advisor to and supervisor of the state highway department heretofore created under chapter 15, laws of 1917.

B. To act as advisor to and supervisor of the work or plans of any commission now or hereafter created by law, to construct any tunnels under the Hudson River, or any bridge or tunnels in or over the Delaware River, as he may be required.

C. To act as advisor to and supervisor of the construction of any work or plans undertaken by any commission or joint commission charged with the development of the Port of New York, or any other port lying wholly or in part within this state, as he may be required.

D. To act as advisor to and supervisor of any other engineering project in which the state may be interested, as directed by the governor.

3. The state engineer shall be appointed by the governor for such term as in his judgment he may deem proper. His salary shall be fixed by the state house commission, and payable either out of any funds placed to the credit of the state highway department or in whole or in part out of any other fund credited to any such board or commission, as above set forth; provided, however, that the state house commission may prorate such salary among any of the said boards or commissions for which the state engineer shall perform services.

4. The office of state engineer shall cease and terminate upon the retirement from the said office of the incumbent first appointed by the governor.

5. This act shall take effect immediately.

Improvement of the Butler Plank Road in Pennsylvania

What is known as the old Butler Plank Road, running from Pittsburgh to Butler, Pa., was the subject of a recent consultation between the State Highway Department and delegates from Allegheny and Butler counties.

It was announced by the county commissioner representing Butler County that the county would pay one-half of the cost of improving the Butler Road or other state highways in the county, and that it was prepared to issue bonds to aid in the construction. It was stated that Allegheny County would improve the road to the county line. The State Highway Commissioner agreed to go over the route of the proposed improvement, fixing May 4 as the date for the inspection, but said that no definite plans could be made by the department until the legislative appropriations were made.

Chief Engineer Uhler announced that bids would be asked for the Butler viaduct as soon as the Public Service Commission made its final order.

NEWS NOTES

Nebraska Has One Automobile for Every Ten Inhabitants, and in this respect ranks second among the states of the Union, according to report.

On March 30, Governor Whitman of New York, signed the Machold bill which makes available the sum of $4,075,000 for the maintenance and repair of state and county highways.

The Road and Bridges Committee of the County Board recently approved the bid of John A. McGarry & Co., of $175,693.72, for paving 8½ mi. of Ninety-fifth St., Chicago, Ill. The improvement will be made between Western and Keane Aves.

That Highway Maintenance Will Not Be Efficiently Organized Until Road Officials Are Appointed, rather than popularly elected, at salaries adequate to insure the employment of trained men with experience in highway projects, was the conclusion reached by both Dr. L. I. Hewes, District Engineer, United States Office of Public Roads, and George F. Cotterill, Chief Engineer of the Washington State Highway Commission, at the second annual road builders' convention at Seatle. "More adequate funds for the maintenance of highways are desirable," declared Dr. Hewes. "As the mileage increases, the cost of upkeep increases also. In the meantime the unimproved roads must be kept in repair at the lowest cost possible. Cheap maintenance depends entirely on good construction. The cost of repairs could be made negligible by proper upkeep." He explained that only 10% of the public highways are improved and pointed out that technical schools to train our highway employees are becoming essential to the cause of good roads.

GOOD ROADS

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Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

APRIL 21, 1917.

ENGINEERS, CONTRACTORS AND SPECIFICATIONS

Unusual interest attaches to the discussion of "The Contract and Specifications for Paving," by Charles A. Mullen, printed on other pages of this issue, because of Mr. Mullen's experience both as an engineer and a contractor, and also because not all engineers and contractors will be willing to subscribe to some of Mr. Mullen's statements. The extracts printed are from a paper presented by Mr. Mullen at the recent good roads meeting at Ottawa, Ontario.

The relation between the engineer and the contractor on road work has been the subject of papers and discussions at many road conventions, but only occasionally has either an engineer or contractor approached the subject with the frankness displayed by Mr. Mullen. In many instances both engineers and contractors have failed to realize the desirability of closer cooperation with each other, but we believe that the careful consideration given to the matter during the past few years has brought about a much better understanding. At the same time it cannot be doubted that there is still room for improvement in their relations, and it is certain that much of the antagonism so frequently found can be traced to the faults of the prevailing methods of preparing specifications, making estimates and drawing contracts.

According to Mr. Mullen, the interests of the highway department and those of the contractor are diametrically opposed, one standing in the position of the buyer and the other in the position of the seller. He claims also, and rightly, that a contractor's main reason for building a road is the profit there is in it, but we can hardly agree with his contention that the contractor of the better class is only "mildly interested" in the quality of the work done. On the other hand, we are thoroughly convinced that the majority of contractors are like the majority of other men in that while they work primarily for financial gain, they nevertheless take a considerable amount of pride and derive no little satisfaction in doing good work and that if conditions permit it they prefer doing good work to poor work. There are, of course, exceptions to this among contractors, as there are exceptions among other workers, but we believe that any other attitude than that indicated is exceptional rather than usual.

Another part of Mr. Mullen's discussion with which all engineers will probably agree is that portion in which he discusses the attitude of public officials toward engineers in their employ. Many officials—and the people they supposedly represent—seem to think, as Mr. Mullen puts it, "that because they have hired a man who is a graduate engineer, he should be able to solve any problem put to him without special assistance." This assumption must have been noted by everyone familiar with the conditions ordinarily surrounding public work. The man who is qualified to hold a position such as city engineer in a small city ought not be expected to have the expert knowledge which will sometimes be required in the solution of municipal problems, any more than the family physician—to again borrow one of Mr. Mullen's illustrations—should be expected to have the requisite knowledge and skill to cope with those not uncommon situations in which the services of a specialist or a surgeon are required. The city or town engineer when confronted with some large work involving unusual features should feel free to call in a consultant who has specialized in the particular kind of work to be done. Provisions should be made for meeting the expense of such a course, and the public should understand that the request for expert advice on the part of the engineer is in no way indicative of any lack of competency.

The part of Mr. Mullen's paper dealing with the matter of guarantees contains much that is worthy of careful consideration. Mr. Mullen holds that the contractor having been told how to build a road should not be called upon to guarantee it, but that the guarantee should be required of the man responsible for the design and specifications. The guaranteeing of pavements by the contractor has frequently been condemned, but it seems to be a custom that has been followed for so long that it is difficult to eliminate. Certainly it is unfair to ask a man to guarantee a structure in the design of which he had no part. While the guarantee is not intended to cover exactly that situation it is a fact that in many cases it is in effect exactly what Mr. Mullen points out. A better plan would undoubtedly be to provide a guarantee that the specifications would be followed both in letter and in spirit, but before this would be feasible it would be necessary to devise specifications far superior to those ordinarily employed in road work.

The Levy Court of Delaware was recently authorized by the legislature to borrow $500,000 for constructing the Lincoln Highway in that state. The route will follow the Philadelphia Pike to Wilmington and extend to the Maryland line at Iron Hill.

The Motor Roads on the Isthmus of Panama do not form continuous routes at the present time, due to the absence of a road across the Isthmus and the fact that work on the Canal has cut off highway communication with the west side. according to the "U. S. Commerce Reports." The principal area in which automobiles may operate embraces the City of Panama, the Canal Zone as far as the Chagres River, and roads leading into rural sections (Sabanas district) toward the ruins of Old Panama and the Juan Diaz River, comprising a total mileage of 86.3. The area of second importance includes Colon, Cristobal in the Canal Zone, and a road leading to Gatun, having a total of 17 mi. A new road to Fort Randolph 5 mi. long is being constructed. The third area embraces the villages of Culebra, Empire and Las Cascades, and the Empire-Chorrera Road, having a total mileage of 18. According to the report, the roads are in condition to be easily traveled by automobiles, and the work of improvement is going on all the time. Fifteen miles of asphalt-concrete are being built at the south end of the Zone; these have a Telford base on which is placed a layer of macadam with a surface of asphaltic-concrete. The roads have been found to withstand both traffic and the wearing rains of the tropics.

Tar and Sand Grouted Roads in Massachusetts

By COL. WM. D. SOHIER†

Mr. Brodie, City Engineer of Liverpool, and one of the most experienced road builders in the world, has developed a form of construction that he believes will prove economical —and has proved economical—for ordinary light city traffic, but not for heavy teaming.

Certainly when some of his roads were twelve years old, in 1914, the roads built by this method were in most excellent condition. They had not been patched or resurfaced, whereas the water bound macadam road just beyond, carrying the same traffic, had been lightly resurfaced every year.

The usual method is as follows: After the foundation is properly prepared and well compacted, about 4½ in. of 2-in. to 2½-in. stone is spread and well rolled. This is grouted with pitch and sand, mixed and kept constantly agitated. They then spread and roll in with a steam roller stone of about 1½ in., which is grouted with pitch and sand and rolled down with a steam roller, the wheels of which are kept constantly wet. Into this top they roll chips or ¼-in. stone.

During the last few years they have been putting on a surface application of the pitch and sand and covering it with pea stone, all well rolled.

In Liverpool the tar and sand is usually heated at a central plant and hauled to the road by a steam tractor. The tar and sand is mixed in a "dandy," which is a 2-wheeled, 35-gal. tar kettle. They use about an equal quantity of tar and sand, to 60% sand. This is mixed and kept constantly agitated by a man with a paddle. The men pour it by hand from buckets that hold about 1½ gal., pouring it very evenly.

The sand used is a fine sand about like the sand used in plastering. The important point is to secure a sand that is the right size to stay in suspension in the tar and not settle to the bottom too quickly. Of course, the coarser the better, if it can be kept evenly in suspension until used. The tar and sand are both heated to about 250°F.

Mr. Brodie, if I remember correctly, figured the additional cost of this work over and above the cost of a water bound macadam, at from 25 to 35 ct. per sq. yd.

Where we have constructed some roads of this character, we have heated our sand and tar at the roadside, using tar kettles, and a sand heater to heat the sand. We built a box on wheels, sloping to the end, and had a flexible pipe with a flat nozzle from which the tar and sand mixture was poured into the road.

In Natick, where some work of this character was done in 1914, the old macadam road was scarified; about 2 in. of 2½-in. stone was spread and rolled; this was grouted with the tar and sand mixture, and finer stone was rolled in. The cost was about 73 ct. per sq. yd. The road has been most satisfactory, and it certainly looks now as if it would last for ten years at least, on a road with about 50 trucks a day and over 700 motor vehicles.

We have used this method of construction on quite a number of stretches of road, especially on grades, as it seems to be less slippery for horses than any other type of bituminous surface, especially if the surface coat is left off and the stones are allowed to project a little.

The tar and sand seems to stiffen and strengthen the whole road, and we believe the use of the sand prevents the tar from oxidizing for many years, and thereby adds to the life of the road.

We developed this year a very good contrivance for securing an even distribution of the mixture. Two plank bridges were made that bridged the road. They were of 2-in. plank, supported in the middle on a 2-in. plank on the crown of the road and built up on the sides. Another 2-in. plank, running lengthwise of the road, was supported on these, and the man pouring the mixture walked along this plank, holding his bucket right against the plank and walking at a rate of speed that just emptied the bucket in the length of the plank. A flat-nosed bucket was used, with a nozzle about 8 in. in width.

By placing the bridges the right distance apart, one bucket covered just the proper area. We poured about 2 gal. to each square yard of surface. Keeping the bucket against the edge of the plank secured a straight edge on the road. The plank was then moved along on the bridges across the road, and the process was repeated, until the whole width was done. There were practically no spaces left where the voids were not filled, and the bitumen did not lap. By keeping the same men on the pouring and having the hot mixture brought to them, uniform results were insured and the work progressed rapidly.

In England, in several instances, I think in all where they were rolling either a sand pitch grouted road, or grouting with tar a stone road, they were wetting the wheels of their roller. In one or two cases they had a man on each side constantly pouring water on the roller wheels. This was to prevent the tar from picking up on the wheels of the roller.

In Liverpool they make a little ordinary water box and place it over the wheel of each roller. In the bottom of the box they leave a little opening on one side, and put in a piece of crash or linen toweling, which hangs down over the roller wheel and keeps it just moist, the roller man filling the box from time to time with water. They say it dos not need much water, but merely enough to keep the wheels of the roller damp, and when they tried other methods they got too much water and it interfered with the hot tar surface, pitting it. The box is just the width of the roller wheel, about 12 to 14 in. square. When they used too much water, they got blow-holes in the tar.

Bids Asked on State Highway Work in Pennsylvania

Contracts are to be awarded for state highway work in various counties in Pennsylvania on bids that will be opened by the State Highway Department on May 3. The work advertised is as follows:

Dauphin County, Swatara Township, State Aid Application No. 570, 1,270 lin. ft. vitrified brick pavement.

Clarion County, Clarion and Paint Townships, State Highway Route 65, 14,128 lin. ft. vitrified brick pavement.

Cambria County, Jackson and East Taylor Townships, State Highway Route 52, 32,923 lin. ft. vitrified brick and reinforced concrete pavement.

Washington County, Cecil and North Strabane Townships, and Allegheny County, South Fayette Township, 36,170 lin. ft. vitrified block and reinforced concrete pavement. The construction of this section of road will complete the route between Pittsburgh and Washington by way of the old Pittsburgh Pike.

The Bid of the Andrews Asphalt Paving Co., of Hamilton, Ohio, of $160,400 for paving the Cincinnati and Hamilton Pike with bituminous concrete has been recommended for acceptance by the county commissioners.

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*Extract from a paper entitled, "Bituminous Macadam Roads," presented at the Fourth Canadian and International Good Roads Congress, Ottawa, Ont., April 10-14, 1917.

†Chairman, Massachusetts Highway Commission.

MEETINGS

Calendar of Coming Meetings

May 7-9.—National Conference on City Planning—Annual Conference, Kansas City, Mo. Secretary, Flavel Shurtleff, 19 Congress St., Boston, Mass.

May 8-9.—Institute of Paving Brick Manufacturers—Convention St. Louis, Mo. Secretary, H. H. MacDonald, 830 B. of L. E. Building, Cleveland, O.

May 23-24.—Michigan State Good Roads Association—Annual meeting, Saginaw, Mich. Secretary, A. A. Anderson, Hastings, Mich.

June 11.—New York State Conference of Mayors and Other City Officials—Annual Conference, Buffalo, N. Y. Secretary, W. P. Capes, 25 Washington Ave., Albany, N. Y.

June 26-30.—American Society for Testing Materials—Annual meeting, Atlantic City, N. J. Secretary, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

Postponement of the Spring Meeting of the Portland Cement Association

According to advices received from the Portland Cement Association, the spring meeting of the association, which as noted in previous issues was to have been held at San Francisco, Cal., on Monday, Tuesday and Wednesday of this week, was postponed indefinitely, owing to international complications and possible consequences.

Florida Good Roads Association

The program of the twentieth annual convention of the Florida Good Roads Association was successfully carried out at Tallahassee on Wednesday and Thursday of last week. Vice President J. R. Benton presided at the opening session and addresses of welcome were made by Gov. Catts of Florida and Mayor Lowery of Tallahassee. Dr. Benton delivered his annual address on "The Year's Work." Later in the afternoon the members and visitors became the guests of Tallahassee citizens on an automobile ride over the Old Spanish Trail, Dixie Highway and other interesting roads about the city.

The evening session was held in the Hall of the House of Representatives and was presided over by Hon. Cary A. Hardee, Speaker of the House, who expressed himself as favoring the recommendations of the Florida State Road Department for legislation to develop highway improvement in the state. Geo. P. Coleman, State Highway Commissioner of Virginia, the first speakar of the evening, recommended the utilization of convict labor on Florida road work, and explained the methods by which prisoners have been used successfully in his own state. Other speakers of the evening were F. O. Miller, of the State Road Department; W. S. Keller, State Highway Engineer of Alabama; Ed. Scott, Chairman of the Florida State Road Department, and J. T. Bullen, District Engineer of the U. S. Office of Public Roads and Rural Engineering. A part of the morning session of Thursday was conducted by the good roads department of the State Federation of Women's Clubs, and proved an interesting feature of the convention. The value of good roads to the woman on the farm was among the topics presented at this session.

The election of officers of the Association for 1917 resulted as follows:

President, H. G. Aird, Jacksonville; Vice President, Joe Hinely, Madison; Secretary, R. T. Arnold, Jacksonville; Treasurer, J. P. Clarkson, Tallahassee; Chairman of Board of Governors, Dr. J. R. Benton, Gainesville.

Executive Committee: Officers named above and Judge H. B. Philips, Jacksonville; Major A. B. Small, Lake City, and Frank A. Wood, St. Petersburg.

Pacific Highway Association

The meeting of the Pacific Highway Association scheduled for April 10, which was noted in these columns in the issue of April 7, has been postponed until 10 a. m., April 30.

The meeting will be held in the Press Club, Seattle, Wash., and, as previously noted, the matters to be considered will include the asking of Congress to build a military highway along the Pacific Coast, the appointment of a committee to coöperate with local authorities toward the completion of the hard surfacing of the Pacific Highway, and the appointment of a committee to cooperate with federal officials in mapping and planning military highways in California, Oregon and Washington.

Officers of the Alabama Good Roads Association

In a report of the meeting of the Board of Directors of the Alabama Good Roads Association, published in the issue of April 7, an incorrect report of an election of officers was printed. Messrs. Gulledge and Brown were elected members of the Executive Committee, instead of President and Secretary, respectively, as stated in the item.

The officers of the Association are: President, John Craft, Mobile, Ala.; First Vice President, John W. O'Neill, Birmingham, Ala.; Second Vice President, J. E. Pierce, Huntsville, Ala.; Third Vice President, U. S. Senator John H. Bankhead, Jasper, Ala.; Fourth Vice President, U. S. Senator Oscar Underwood, Birmingham, Ala., Secretary, J. A. Rountree, Birmingham, Ala., and Treasurer, I. B. Elliot.

Granite Paving Block Manufacturers' Association

A convention of the Granite Paving Block Manufacturers' Association was held at the Hotel Belmont, New York, N. Y., on Tuesday afternoon of this week.

The meeting was devoted principally to the discussion of various matters of interest to the producers of granite paving blocks. There were also passed resolutions providing for cooperation with the government. These resolutions were embodied in a letter transmitted to the Secretary of War, which follows:

To the Secretary of War,
Washington, D. C.

Dear Sir:

I have the honor of transmitting to you herewith the following resolution passed at a convention of the Granite Paving Block Manufacturers' Association of the U. S., Inc., held at the Hotel Belmont, New York, N. Y., April 17, 1917:

> RESOLVED, That the cooperation of this Association, together with the services of the Consulting Engineer, be offered the National Government gratis.
>
> That 10% of the output of the members of the Association be offered the National Government at cost for their regiments for military purposes; such cost to be determined by the National Government.

If the War Department or any other branch of the Government finds that it can use our association in the construction of military roads, or otherwise, or in the supplying of material therefore, please communicate with me and it will receive the immediate attention of our consulting engineer and the Executive Committee.

Yours respectfully,
(Signed) JAMES ADAMSON,
Secretary.

Motor Truck Club of America

The regular monthly meeting of the Motor Truck Club of America was held at Churchill's restaurant, New York, N. Y., at noon on Wednesday, April 17.

The principal matter before the meeting was the recruiting of the motor truck reserve companies which the club has agreed to raise. The principal speaker was Maj. S. P. Witherill, of the Officers' Reserve Corps, representing the Quarter Master's Department. The plan of the club involves the recruiting of the companies and the drilling of the men in the handling of trucks in military operation. George H. Duck, a former president of the club, has been designated as examiner of the volunteers. His headquarters will be at Governor's Island, N. Y. It is understood that recruiting will be carried on in the states along the Atlantic Coast, with subcommittees working at Boston and Charleston.

Fourth Canadian and International Good Roads Congress

On Tuesday afternoon, April 10, the Duke of Devonshire, Governor General of Canada, formally opened the Fourth Canadian and International Good Roads Congress at Lansdowne Park, Ottawa, Ont., declaring that the object of the convention—to promote the improvement of highways throughout the Dominion—was of supreme importance and should receive the cooperation of all classes in the community.

Sir George Foster and Sir Wilfrid Laurier attended and each expressed himself in hearty accord with the newer and progressive policies of road building, the former promising the cooperation of the government in furthering such policies. Bishop Roper referred to the social and religious benefits gained from good roads.

President J. Duchastel welcomed the Governor General and others assembled on behalf of the Dominion Good Roads Association, under whose auspices the congress was held.

Mayor H. Fisher welcomed the delegates to Ottawa. B. Michaud, Deputy Minister of Roads of Quebec, responded to the address of welcome, and stated that the government was anxious to give the province much needed improvement in highways. Road officials from the United States were enthusiastically welcomed by the delegates from Canada. After the opening ceremony, the afternoon was devoted mainly to official proceedings and organization.

Wednesday, April 11, was occupied by a series of addresses and papers on road building. W. A. McLean, Deputy Minister of Highways of Ontario, explained the methods under which the province extended aid to municipalities, and said, "Let us put in a substantial foundation and get permanent superintendents in charge of highways; there has been too little experience among road builders."

James H. MacDonald, ex-State Highway Commissioner of Connecticut, declared that Canada's growth would depend upon an improved highway system from one end of the domain to the other. Geo. Hogarth, Chief Engineer of the Ontario Highway Department, read a paper on drainage and foundation, which was discussed by Messrs. Michaud, McLean, MacDonald, Wm. D. Sohier, W. Huber, L. B. Howland, E. Drinkwater, and others.

The annual banquet of the Association was given at the Chateau Laurier on Wednesday evening.

Among those who presented papers on road subjects or participated in the discussions at other sessions were Col. Wm. D. Sohier, Chairman of the Massachusetts Highway Commission, who spoke on "Bituminous Roads and Pavements"; Wm. H. Connell, Chief, Bureau of Highways, Department of Public Works, Philadelphia, Pa., on "Granite Pavements"; R. B. Morley, General Manager, Ontario Safety League; Frank Carrell, President of the Quebec Automobile Club; A. Fraser, of Quebec; D. T. Black, Town Engineer of Welland; L. Reinecke, Geological Survey, Ottawa; Thomas Adams, Town Planning Adviser, Commission of Conservation, Ottawa, and W. Huber, Assistant Engineer, Ontario Department of Highways.

The exhibit which was shown in Horticultural Hall consisted of machinery and implements for use in road construction, including mixers, graders, and tractors. Improved methods of building various types of highways were shown by designs and models, and educational pamphlets were displayed for distribution. A large and interesting exhibit was made by the Ontario government.

The congress closed on Saturday with the annual meeting, reports of committees and the election of officers.

Jackson County, Missouri, Permanent Highway Association

The Jackson County Permanent Highway Association was organized at a meeting of the Chamber of Commerce and the Automobile Club, at the Hotel Muehlebach, Kansas City, Mo., April 5. George E. McIninch, of the Missouri Highway Commission, A. W. Graham, recently appointed State Highway Engineer, and a number of public officials made addresses.

The object of the association is to promote the construction of permanent highways in Jackson and adjoining counties and to cooperate with other road organizations in the building of interstate highways. Edward N. Hines, Chairman of the Board of County Commissioners of Wayne County, Mich., was present and spoke on concrete roads, which the association is reported as advocating.

F. J. Bannister, Secretary of the Long-Bell Lumber Co., was elected president.

NEWS NOTES

Laurens County, South Carolina, at a special election has voted to issue bonds to the amount of $300,000 for road improvement.

Street Pavement Will Be Laid in Elkhart, Ind., during the summer at an estimated cost of $150,000, according to recent advices.

Washington County, Oklahoma, is planning to construct 121 miles of improved highways, providing an extensive county system, at an estimated cost of $600,000. The roads are to be 16 ft. in width.

Thurston County, Washington, is the first county in that state to receive federal aid for road improvement. The amount received by it, $28,000, is to be used for the construction of 4 mi. of concrete pavement 20 ft. wide.

Missouri Now Has 114,098 Automobiles and 1,075 car dealers. The revenue to be derived from motor license fees in the state under the new road law will amount next year, it is stated, to $1,000,000. The money will be devoted to road improvement.

Citizens of Effingham County, Georgia, have raised a fund for the improvement of the highway from Savannah to Statesboro by way of the Ogeechee River Road and Pineora. The route was decided upon by the county commissioners and the Savannah Association of the Dixie Highway.

The Elimination of Bad Spots in the Dixie Highway between Macon, Ga., and Jacksonville, Fla., is to be accomplished as far as possible by a unique method which provides that passing automobilists pick up and carry one or more sacks of sand and clay to places on the road needing repair. For the purpose sack stations will be conveniently located at the city limits of Waycross, Folkston, Douglas, Fitzgerald and other points en route. It is stated that the plan has been adopted by the members of the Dixie Highway Association at Waycross.

PERSONAL NOTES

H. M. McIntosh has been appointed State Engineer of Vermont.

W. Nial Rook, County Road Superintendent of Bradford County, Pennsylvania, has been appointed County Road Superintendent of Indiana County.

Carlile P. Winslow has been appointed Director of the U. S. Forest Products Laboratory, at Madison, Wis., to succeed Howard F. Weiss, whose resignation was noted in a previous issue. For the past four years Mr. Winslow has acted as Assistant to the Director of the laboratory, and his selection was due in a great measure to his familiarity with the work and his knowledge of the problems to be studied. He is a graduate of the Sheffield Scientific School of Yale University, 1905, and entered the forest service in 1908.

Charles N. Danehower, a contractor of Cincinnati, Ohio, died recently in that city. He was City Engineer of Cincinnati for several years.

H. M. Garden has resigned as City Engineer of San Angelo, Tex., his resignation to take effect as soon as another engineer can be appointed.

Ford & McRae, of Little Rock, Ark., are to have charge of the engineering work to be done in the Arkansas-Louisiana Highway District, in which a large amount of highway construction is planned.

Edgar S. Closson has opened offices in the Plaza Building, Montclair, N. J., for the practice of consulting engineering, including the construction of roads and pavements. For the past four years Mr. Closson has been Town Engineer of Montclair. C. J. McGiffert, his assistant during the above period, will be associated with him.

Resignation of George W. Cooley

George W. Cooley, for the past eleven years State Engineer and Secretary of the Minnesota State Highway Commission, retired from active service on April 10.

Mr. Cooley, who was formerly County Surveyor of Hennepin County, was appointed State Engineer and Secretary of the State Highway Commission by Governor Johnson of Minnesota in 1905 when the State Highway Commission was established, and has served in that capacity since. In 1909 he visited Norway, Sweden, Denmark, Germany, France, England, Switzerland and Italy to study roads and road work, and upon his return he established the European system of maintenance on the Minnesota roads. He has been a prominent figure at road conventions in the country road work, and upon his return established the European.

Although his retirement was not necessitated by the new highway law passed by the legislature this year, Mr. Cooley stated that he had served for a long time and felt that he had earned a rest. At last reports no successor to Mr. Cooley had been appointed by State Highway Commissioner Babcock.

Death of Earle C. Bacon

Earle C. Bacon, who carried on a business in rock and ore crushers and other mining and general machinery under the name of Earle C. Bacon, Engineer, died on April 9 at his country home at North Salem, N. Y. Mr. Bacon's death resulted from gastritis after a short illness.

Mr. Bacon was born in Providence, R. I., in 1849, and had been in business for nearly 50 years. He began his career with the Delamater Iron Works of New York, N. Y., and at the age of 21 formed a partnership with C. E. Copeland, under the firm name of Copeland & Bacon. This firm was dissolved in 1893 and from the following year until his death Mr. Bacon carried on the business under his own name. Mr. Bacon was largely instrumental in the development. The pan has a capacity, level full, of 280 gal. and mining machinery. For nearly 40 years he was associated with the Farrel Foundry & Machine Co. in the designing, building and marketing of the Farrel jaw crusher and other machinery.

Mr. Bacon was a member of the American Society of Mechanical Engineers and of the Union League and Machinery Clubs. His will named Stanley K. Greene as sole executor. It is understood that Mr. Greene, who had been associated in business with Mr. Bacon for a long time, will continue the business along the former lines.

LETTER TO THE EDITOR

Maintenance Costs on the Chevy Chase Experimental Road

Editor "Good Roads:"

In the issue of "Good Roads" of April 7 there is an advertisement on page 23 by the Barber Asphalt Paving Co. categorically showing the cost of maintenance on the Chevy Chase experimental road, built by the U. S. Office of Public Roads, from 1911 to January, 1916, with a comparison of the maintenance cost on Bermudez Asphalt road with roads built of tars and so-called "oil asphalts."

In order that no one may be misled by this advertisement or that there may be misapprehension on any one's part, we wish to state that Aztec Asphalt was not laid on any part of this road and should not be included in this comparative test.

In justice to the producers of other asphalts of Mexican origin and the interests of facts, it also might be well to state that none of the so-called oil asphalts referred to in this list were of Mexican origin.

J. R. DRANEY,
Sales Manager,
New York, N. Y. The United States Asphalt Refining Co.

NEWS NOTES

Street Work to Cost $200,000 is being planned for Thomasville, Ga. It is expected that bonds for $100,000 will be issued.

Two Thousand Men Were Put to Work on Pennsylvania state highways during the week of April 2, according to a report.

The Special Road Bond Election to be held in Elk District, Kanawha County, West Virginia, was postponed from April 16 to April 24. The amount to be voted on is $335,000.

The Good Roads Association of Robertson County, Tennessee, is behind a movement to secure a bond issue of $150,000 for the repair and extension of pikes in the county.

A Unique Method of County Road Inspection without cost has been advanced by Charles M. Upham, County Road Engineer of Sussex County, Delaware. The plan is to have the rural mail carriers send in a daily report, on a blank furnished by the engineer's office, of the condition of roads and bridges throughout the county. The plan is said to have the approval of the county officials, and the Post Office Department at Washington has been requested to grant permission for putting it into execution.

EQUIPMENT — TRADE — MATERIALS

Chilcott-Nash Company to Distribute Nash Products in the Northwest

The Chilcott-Nash Co., of Seattle, Wash., has been formed to distribute the product of the Nash Motors Co., of Kenosha, Wis., in the Northwest.

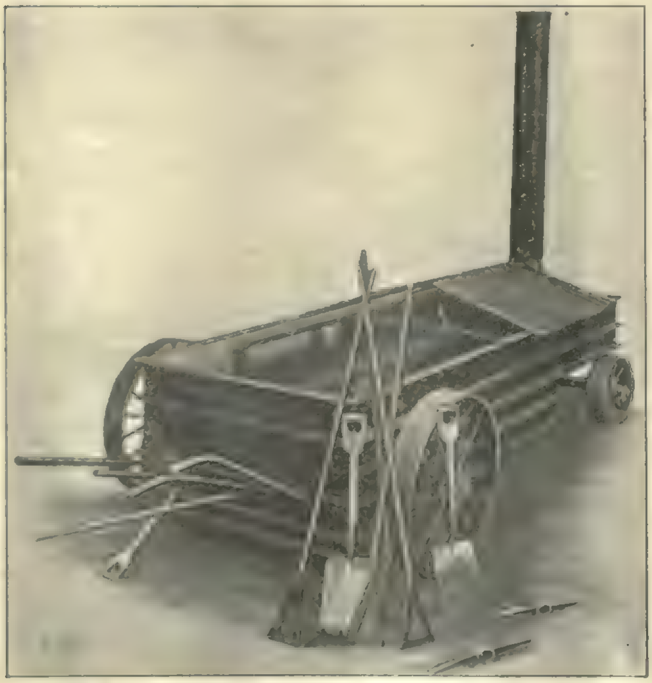
W. K. Chilcott, formerly sales manager of the General Motors Truck Co., will head the new organization. The territory assigned to the Chilcott-Nash Co. includes Oregon, Washington, northern Idaho, western Montana and Alaska. The company's headquarters will be in Seattle.

New Asphalt Repair Wagon

An asphalt repair wagon designed for use in municipalities having no asphalt plants is shown in the accompanying illustration.

The wagon consists of a melting pan and fire box, mounted on four wheels and provided with a cover and smokestack. The sides are made of standard channel sections closely riveted together. The body is 11 ft. 3 in. long, 4 ft. 8 in. wide and 2 ft. 6 in. deep. The height above the ground, exclusive of the stack, is 2 ft. 11 in. The heating pan is 10 ft. long, 4 ft. 2 in. wide and 1 ft. 2 in. deep, inside measurement. The pan has a capacity, level full, of 280 gal. and is provided with a corrugated iron cover which is removable in sections and serves not only to keep out rain but to retain the heat in the mixture. The fire box has a grate area of 34.6 sq. ft. and is adapted to either coal or wood. There is an ash pan under the grate to prevent the spilling of ashes on the pavement. The tools can be heated by inserting through the rear fire door, as shown in the illustration.

The machine can be used for remelting old asphalt pavement removed from the street, for remelting cakes of new mixture, for heating sand and stone with asphalt cement, or for drying and heating sand, gravel or stone. From 50 to 75 sq. yds. of 2-in. pavement can be patched per day, according to the manufacturer's rating. The total weight is 4,200 lbs.



NEW IROQUOIS ASPHALT REPAIR WAGON.

The wagon is made by the Iroquois Works of the Barber Asphalt Paving Co. at Buffalo, N. Y.

"Concrete Highway Construction"

An attractive and useful booklet bearing the above title has been issued by the Atlas Portland Cement Co. for the instruction of road builders. Beginning with the essentials of a good road—"permanence, reasonable cost of construction, and low cost of maintenance"—advice is given on the various stages of the operation. The approximate estimates of the equipment and the organization required, with costs, are given in tabular form, as are suggestions as to proper methods of preparing itemized proposals. Advice to contractors in making bids, and skeleton forms for cost data on labor, materials and machinery are also included.

The illustrative features of the booklet, half-tone photographs and diagrams, are excellent. The booklet is obtainable from the Atlas Portland Cement Co, Highway Department, 30 Church St., New York, N. Y.

NEWS NOTES

Coos County, Oregon, is to have three wooden lift bridges of the single leaf bascule type, designed by Lewis W. Metzger, Engineer of the State Highway Department.

The Commissioners Court of Wichita County, Texas, has called an election for May 24 to vote on issuing $750,000 in bonds, the proceeds to be used in the construction of 110 mi. of improved roads.

The Authorities of Nueces County, Texas, have awarded a contract for constructing a modern highway from the east limits of Corpus Christi to Flour Bluff, a distance of about 12 mi., at a cost of $158,000.

The Hokes Bluff Highway From Attalla to Gadsden, Ala., is to be hard surfaced as far as money now available will carry the work. The present fund—$20,000—it is expected will build from 7 to 8 mi., first deducting the cost of a concrete bridge and a half mile of asphalt near Gadsden.

Paving Contracts Recently Let in Columbus, Ohio, call for brick construction on Fifth Ave., Fields to Cleveland Ave., $11,064; asphalt on Pace Ave., High St. to east terminus. $18,996.60; brick on Lafayette St., 5th St. to Grant Ave., $5,631, and brick on Welch Ave., 4th St. to Washington Ave., $20,335.

The Graveling of 18 mi. of the Alpena County, Michigan, Road System is to be placed under contract, according to a news report. The specifications call for 60% screened gravel 4 in. deep and 9 ft. wide. The mileage includes 5 mi. on the Long Lake Road, 4 mi. on the Wilson-Hillman Road and 6 mi. on the Hubbard Lake Road, each starting at the city limits of Alpena, and 2 mi. on the Long Rapids Road, from Orchard Hill Corners west.

The Traffic Bureau of the Chamber of Commerce of DuBois, Pa., is working on plans for the development of a cardinal highway through Pennsylvania from Bradford, in McKean County, at the north, to Cumberland, Md., on the south, either by way of Mount Jewett, Johnsonburg, Ridgway, DuBois, Curwensville, Ebensburg, Johnstown and Bedford or through DuBois, Clearfield, Phillipsburg, Tyrone, Altoona, Hollidaysburg and Bedford. Both routes are interesting from a scenic standpoint.

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Methods and Costs of Employing Convict Labor on Virginia Road Work*

By GEORGE P. COLEMAN†

Virginia, I may state, was one of the pioneers in this work [convict labor on the public roads]. The legislature in 1906 passed what is known as the Withers-Lassiter convict law, placing the convicts of the state at the disposal of the state highway commissioner for road improvement and making an appropriation of $25,000 for experimental purposes. This plan has been so successful that the last legislature appropriated $200,000 from the general funds and approximately $50,000 in jail fees for this division of the Highway Department. Under this law a county desiring convict labor in its road work makes application through its local road authorities to the state highway commissioner for convict aid, stating in this application the amount of funds available on the part of the county for the work, designating the roads to be improved and giving such other information as may be required by the commissioner. If the road in question is of sufficient importance to be improved and sufficient funds are available on the part of the state for the maintenance of the camp, the commissioner makes requisition on the superintendent of the pentitentiary for a camp of men, advising him of the location of the work to be undertaken and the number of men required.

These camps vary in size from 35 to 100 men, according to the character of the work to be undertaken. A sergeant with from three to five guards is selected from a list furnished the superintendent of the penitentiary by the highway commissioner. The commissioner has the right to require their discharge at any time should their services prove unsatisfactory. The sergeant receives from $600 to $900 and board per annum; the guards from $300 to $420 and board per annum. These salaries compare favorably with those paid in other states.

The camp is composed of three buildings—a sergeant's and guards' house, a cell house, and a dining house. The first of these, the sergeant's and guards' house, consists of two rooms and is 15x36 ft. The sergeant's room is also used as an office and armory. The cell house for the men is

A STONE CRUSHING PLANT OPERATED BY CONVICT LABOR IN VIRGINIA.

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*From an address at the twentieth annual convention of the Florida State Good Roads Association, Tallahassee, Fla., April 11-12, 1917.

†State Highway Commissioner of Virginia.

20x72 ft., with a row of bunks down each side and a passageway through the center. It is heated in winter by three stoves. The dining house, 20x56 ft., is divided into a dining room for the men, a dining room for the sergeant and guards, a store room for supplies and the kitchen. All of these buildings are of the knock-down type, that is, are so constructed that they can be readily taken down and reerected at a new location. We use corrugated iron for roofing and 10- to 12-oz. duck for sides. All of the woodwork where possible, is either bolted or screwed together. When the camps are sent out they have all necessary arms, cooking utensils, bedding, clothing and sufficient general supplies to last about 60 days. Exclusive of clothing and provisions, these camps cost $1,840. Camp sites are selected with great care, particularly with a view to a plentiful supply of pure water and proper drainage; also that the walk to and from work may be reduced to a minimum. This, in the most extreme cases, should not exceed 2½ mi. The cooking and washing, and in fact all work about the camp, is done by prisoners under guard is generally followed in the southern work. One man is required for this service for every twelve men in the camp. These are taken from the men who are not capable of doing the heavier classes of road work. The men are divided into gangs of from 8 to 15 and are used in grading, quarrying, etc., each gang being in charge of a guard or foreman. The system of working prisoners under guard is generally followed in the southern states. In the northern and western states the men for road work are selected from the entire convict body and only the better class is used, and frequently used without guards. Our experience in Virginia is that we require a certain number of trusties in each camp, the total for the whole state running to about 36% during the past twelve months, well above the average for the United States. The road work proper is in charge of an engineer or superintendent appointed by the highway commissioner. He receives from $900 to $1,500 per annum and we hope to have this increased to a maximum of $2,100 by the next general assembly. We have found that in many of our camps we can combine the duties of sergeant and superintendent in one man. This should be done in all camps. Leaving out of consideration a small saving in salary, it makes for greater efficiency, since it does away with any conflict of authority, which should be guarded against with the greatest care. We have found it very difficult to accurately define the line between the duties of the sergeant of the camp and the superintendent of construction.

The prisoners are trained in all classes of road work. Trusties are made into roller-men, firemen, blacksmiths, carpenters, drill runners, concrete men, etc., the trusties being selected by the sergeant from the better class of prisoners. The state convict road force is composed of all male convicts, who are considered safe by the superintendent of the penitentiary and all jail men over 16 years of age. This force, when placed on a county road or in a county quarry, is clothed, fed, guarded and transported by the state and placed on the road each morning free of all cost or expense to the county. Prisoners working on road force have, for good behavior, a reduction of ten days per month from the time for which they were sentenced. The men cost a little over 57 ct. per 10-hour working day, which is divided about as follows: Provisions 22.8 ct., clothing 5.7, salaries 19.5, mileage 1.2, all other expenses 8.2. During the first two years when we were organizing this cost was a little over 72 ct.

In my judgment the North and West have erred in attempting to make the camp meals too elaborate, while the South has erred in making them too monotonous. It is certainly true that criminals in the various sections are different, but it is equally true that it would be a mistake to give the prisoner more elaborate or more meager fare than he was accustomed to as a free man.

The federal government has undertaken some experiments along these lines and will no doubt issue a bulletin giving the results obtained.

SPREADING AND ROLLING SCREENINGS BY CONVICT LABOR IN VIRGINIA.

CONVICTS GETTING OUT ROAD MATERIAL IN A VIRGINIA QUARRY.

Our laws contemplate doing the work either by contract or by force account. Under the contract plan the specifications set forth the number of men available, the rate which the contractor will have to pay per hour for their services and, most important of all, the rules and regulations under which the men are worked. These have been very carefully worked out by the highway commissioner and the superintendent of the penitentiary, and to thoroughly protect the convict they are made a part of the contract. Under the second plan, that of force account, we require the county to supply the necessary teams, tools, machinery and other materials and to pay for all necessary free labor to carry on the work systematically and economically. The idea in both classes of work is to divide the cost about equally between the county and the state. We have, however, found the latter the most satisfactory plan, since it is much more flexible and economical. Care should be taken to see that teams, outfit and men are well balanced. Under either plan the work is done directly under the supervision of the state highway commissioner, or an engineer appointed by him. The men, as to discipline, are entirely under the control of the state.

I wish to emphasize here the importance of this point—that of responsibility for the work. If you wish any business to succeed place one man in responsible authority and hold him accountable for results. This is doubly true in the use of prisoners in highway work.

This question of convict labor on roads is one of particular importance to us just now in making our plans to meet the federal aid appropriation. The recent ruling of the United States Secretary of Agriculture, which I think is of sufficient importance to read to you, is as follows:

> (1) Where, in road construction, a state calls for bids and bidders have the option of using free or convict labor, and each bidder has equal opportunity to secure convicts and the lowest responsible bid is to be accepted, the Department is willing to enter into a project agreement on the basis of such bid, without further reference to the terms on which the convict labor may be secured by the contractor.
>
> (2) Where the state has the option of doing the work itself with convict labor and is in a position to call for bids, the Department is willing to proceed with a project on the following basis: It will assent to the state's proceeding with the work on the assumption that it will not cost more than the lowest responsible bid and that the Department will be expected to pay not exceeding 50% of the actual cost, but the convict labor shall not be reckoned in the account at more than the current local rate of wages specified in the project agreement.
>
> (3) In rare cases where bids are not received, or where they are clearly unreasonable, if free labor is employed by the state it shall not be reckoned in the account at more than the current local rate of wages specified in the project agreement.

Under these circumstances I feel that it would be advantageous certainly for my own state to use convict labor in connection with federal aid work. Following that line I propose to recommend to the next general assembly the use by the state of from 1,200 to 1,500 convicts in connection with our federal aid projects, the remainder of the men to be used on state aid work or in the preparation of materials for road building purposes.

Road Drainage and Foundations*

By GEO. HOGARTH†

In building any roadway, whether for light or heavy traffic, two of the most important points to be considered are drainage and foundations.

The stability of the entire road surface depends upon the foundation, and the strength and life of the foundation largely depend upon the facilities provided for drainage. While proper attention may be given to the drainage of the surface of the road by giving the roadway sufficient crown to shed the water, the great importance of subsurface drainage may be entirely overlooked. There are, therefore, surface methods of drainage and subsurface methods of drainage, and the importance of each must be realized and used to the fullest extent if we desire a permanent foundation. A sound and enduring foundation cannot be secured on subsoil saturated with water, but a good foundation can be secured by the simple means of keeping the subsoil dry. If water is not excluded from the foundation it will sooner or later destroy the road surfacing, since no road ever built can escape destruction should the foundation become yielding and soft.

Drainage

The ordinary clays and earths form a naturally strong foundation when dry, but where the ground is wet and springy a good road cannot be constructed without proper subdrainage, since when wet the earth loses its sustaining power and the surface formation goes to pieces. Where the subsoil is gravelly, underdrains will usually not be required, but where it is sandy, give close attention to the damp or wet spots and provide ample subdrainage.

It may be said that the whole problem of the improvement and maintenance of ordinary country roads is one of drainage. Upon earth roads drainage is especially important because the material of the road surface is very susceptible to the action of water and so more readily destroyed than are the surfaces of the better classes of roads. An undrained earth road offers a splendid opportunity to the frost, and a spring thaw may result in such a road being impassable for days or weeks. A road on a wet, undrained bottom will always be troublesome and expensive to maintain, and it will be economical in the long run to go to considerable expense in making the drainage of the subsoil as nearly perfect as possible.

There are three systems of drainage, namely, underdrainage, side ditches, and surface drainage.

Underdrainage will lower the water level in the soil and keep it at a safe distance from the foundation. This aids the action of the sun and wind, which tends to dry the surface of the road; but if the foundation, due to lack of underdrainage, is soft and spongy, the road will soon become a mass of mud.

Underdrainage dries the ground quickly during the spring when otherwise a saturated condition of the soil would exist.

Underdrainage intercepts the subsurface flow of water beneath the crust of the road.

In many cases it will be noticed that though the ground is dry when it freezes in the fall, it is very wet and boggy in the spring when the frost comes out. The reason for this condition is that after the ground freezes, water rises slowly in the soil and if it is not drawn off by underdrainage it saturates the subsoil and rises further as the frost goes out. Underdrainage not only removes the water but reduces, and will in many cases prevent, the destructive heaving effects of frost.

The heaving and cracking of pavements may be entirely attributed to the freezing of water in the subgrade under the pavement. Underdrainage will greatly lessen the damage done in this way by the frost, but to entirely prevent such destructive action may be very difficult. It may be said that when underdraining a section of road known to have a wet subgrade it is well to provide a liberal number of drains. Too many cannot be laid. Particular attention to the underdrainage should be given at points on the road from 50 to 200 ft. or more from the top of a hill or slope and particularly if the roadway is in excavation. Water will usually filter out to the surface at such points and the entire skill of the road builder will have to be exercised in locating subdrainage to prevent heaving and cracking. In all such cases do not curtail the underdrainage but rather put in every foot of tile that can be placed.

Wherever underdrainage is provided be careful to provide proper grade and good outlets for the tile, since poor results will come from tile that are indifferently laid and improperly vented.

Tile drains furnish the usual means for subdrainage, but in some cases a blind drain may be used to advantage. The construction of a blind drain is accomplished by opening a trench several feet deep along or across the road and afterward filling the trench with stone. The depth, distance apart, and location of such trenches will depend entirely upon the conditions encountered and the result desired.

Careful attention to the subdrainage of the road is of great importance and money spent for such work is always a splendid investment.

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*Paper presented at the Fourth Canadian and International Good Roads Congress, Ottawa, Ont., April 10-14, 1917.

†Chief Engineer, Ontario Department of Public Highways.

Side ditches for all country roads are essential. Their object is to receive the water from the surface of the traveled roadway, and the grade to the ditch should be such that the water is carried rapidly to a good outlet. Such ditches also intercept and carry away water that would otherwise flow from the sidehills upon the road. Side ditches need not be very deep; a depth of 2½ or 3½ ft. below the crown of the roadways will usually be found sufficient. The sides should be given a slope flat enough to prevent caving. In order to be effective, ditches should have as great a grade as possible; they should be well cleaned out, and have free outlet in some creek or stream.

Surface drainage of the traveled portion of the road affects mainly the maintenance of the road and is accomplished by giving the road or pavement surface a crown that tends to shed the water to the side ditches. The slope of the crown should be sufficient to carry the water freely and quickly to the ditches. The proper crown to use will vary with the nature of the roadway; when a good surface is maintained a moderate rise will be found sufficient. For earth, clay or gravel roads a usual crown is 1 in. per ft., while for bituminous or concrete pavements ½ or ¼ in. per ft. is ample.

Foundations

While drainage is undoubtedly one of the first essentials of a good highway, the foundation of a road is also of great importance, and one of the first substantial advances in road building was made when the laying of a course of stone for the base of a road was adopted.

The foundation of a road should normally last a number of years, while the cost of maintenance should be for replacing and renewing the worn-out surface. Such conditions are difficult to obtain since the foundation of 4 in. of crushed stone today may be entirely inadequate tomorrow under more severe traffic. The heavy loads using our highways today require an abundance of material in the foundation of the roads and if our work is to be enduring we must see to it that strong and sound foundations are provided.

Frequently the taxpayer may inquire as to why so much material is required in a road and a demand will be made for more surface with a smaller amount of stone hidden in the foundation. Such an inquiry loses weight when the same ratepayer states that a concrete road 6 in. thick is too heavy and his idea of a concrete road is a surface of concrete about an inch thick spread over the entire space between the fences.

Roads built only a few years ago are in many cases in poor condition or destroyed today because a shallow, weak foundation was provided. Improved roads naturally draw traffic and people will go many miles out of their way in order to travel over a section of good road. This fact should be given full consideration in designing a road and any traffic census made prior to reconstruction should be considerably increased in order to estimate the travel on the improved surface. A road is not rebuilt to provide only for present traffic, but it is rebuilt to carry present traffic together with whatever vehicles may use it when improved, and in some cases it may be found that the traffic on an improved road immediately after reconstruction is ten or more times the original number of vehicles using the road.

The strength of the foundation of a road is greatly affected by the supporting power of the different soils and in order to obtain a road surface having a uniform resistance the thickness of the crust will need to be varied. A greater depth of foundation will be required on clay than on gravel, and for soils of intermediate strength a varying thickness will be required. Soils of poor supporting power will carry safely a load of about 600 lb. per sq. ft., while gravel subsoil is safe under a loading of about 3,000 lb. per sq. ft.

Many kinds of foundation courses are available in the construction of roads, such as crushed stone, screened gravel, pit gravel, field stone, quarry stone or telford. Before placing a foundation course the subgrade should be properly rolled in order to solidify the surface and prevent the material of the foundation being forced into the soil. This point is as important with a gravel road as it is with more permanent types of construction. A smaller amount of crushed stone or gravel will be required to build the foundation of a road on a consolidated subgrade, and the rolling and compacting of the subgrade before placing the foundation is, therefore, an economy. A compacted subgrade also enables the foundation of the road to better withstand the effects of heavy traffic, whereas a yielding subgrade tends to cause a sinkage of the foundation with consequent hollows and holes in the road.

Crushed stone where used as foundation for a macadam road should be not less than 6 in. in thickness when compacted, and the size stone will usually be about that passing a 2½-in. ring.

Screened gravel 1 in. to 3 in. in size may be used in place of crushed stone and when placed in the road a filler containing some clay or loam should be spread in order to thoroughly consolidate the stones.

Such gravel does not interlock as crushed stone does and a thicker foundation course of gravel is, therefore, required.

Field stone used for a foundation may be laid in one course from 6 to 12 in. in depth and the inequalities between the stones filled with coarse gravel or crushed stone. The depth of the course should in all cases be suited to the average size of field stone available, as it is not economical to break them to a definite size. A variation of an inch or so in the size of the stone is of no consequence, since the surface stone will serve to even up all inequalities.

The telford base may be composed of quarry stone which has been broken to size with a stone hammer. Such foundations have given good satisfaction when used, but the cost of hand-placing the stones seems to have outweighed the advantages of this type of construction.

In conclusion it may be said that the adequate drainage of a road is the first requisite to performance and, if we add to proper drainage a sound foundation, the cost of maintaining the surface of the road will be greatly lessened. Drainage and foundation are two very essential details of road construction and close attention to these points when designing and constructing a road will lead to better, more durable and more satisfactory roads.

Use of Maps in Highway Work

The laws of many states now require that county engineers prepare maps outlining the road system of the county, showing improved roads and those to be improved, and indicating in detail the location of bridges and culverts, towns, rivers, and in some cases schoolhouses and churches. This map is required as a basis for planning and developing the system, and where it is very extensive is used often to accompany specifications and calls for bids, thus providing the bidder with information as to the relative location of supplies and shipping points, and the exact section or sections upon which the improvement is to be made.

The U. S. Geological Surveys calls attention to the above and to the practical value of the topographic maps for the study of the physical features of an area and the selection of highway routes therein and as a foundation for mapping and constructing highway systems. It is stated that topographic surveys have been made for fully three-fourths of the well-populated portions of the United States, and that index maps of any state are obtainable upon application to the Director, Washington, D. C.

Granite Block Pavements[*]

By **WILLIAM H. CONNELL**[†]

At the convention of the American Road Builders' Association, held in Boston during February, 1917, it was my pleasure to read a paper entitled "Recent Practice in Granits Block Pavements," in which the subject was covered in a general way, so that there is little to be said that is new at this time. However, in going over the preliminary draft of the discussion of this paper, several points were brought out that it might be well to somewhat elaborate on.

Therefore, in order that the subject may be more fully presented to this convention, the first part of this paper will consist of an abstract of the one recently read, followed by an abstract of the discussion, with comments.[**]

In discussing the subject of granite block pavements A. T. Rhoades, Street Commissioner of Worcester, Mass., raised the question as to the advisability of eliminating the pea stone on the ground that the blocks could not be held in position while ramming. In answer to this, attention was called to the fact that with the close joints in the newer types of dressed granite block pavements there would be little, if any, difficulty in this respect. As a matter of fact, in cases where the pea stone has been eliminated no trouble has been experienced. Of course, with the old style, wide joint pavement it is easily seen that it would be necessary to have the pea stone to hold the block in position while ramming.

LOOKING WEST ON BLOOMFIELD AVENUE AT LAKE AVENUE, NEWARK, N. J.—CEMENT GROUTED GRANITE BLOCK PAVEMENT ON AN INTER-CITY ROAD CARRYING HEAVY TRAFFIC.

The purpose of the elimination of the pea stone in the joints was well expressed by Mr. C. D. Pollock, who stated:

> In regard to the disintegration of the grout at the joints, in an investigation made by the Granite Paving Block Manufacturers' Association, we found that the trouble came from the placing of the pea stone at the bottom of the joint for the pinning of the blocks during ramming. Careless workmen get the pea stone high in spots, and consequently obtain a good grout only in the top inch or inch and a half of the joint. Then with heat and damp weather in summer the expansion would bring the load on that small area and crush the top off the blocks. We had cubes made from the bottom portion of the blocks which were intact, and tests made for crushing strength showed that the stone was normal. We found there was no material difference in the causing of these broken joints whether the granite was a comparatively sound granite, or the hardest paving block in the New York market. We made these examinations in Brooklyn and New York and Newark, and surrounding places. I think the whole of that trouble is caused by having the pea stone at the bottom of the joints. If you eliminate that and get the grout clear down to the bottom of the joint, you will find no failures.

Of course, it is perfectly obvious that in order to lay good pavements we must eliminate all possible conditions that are likely to result in failure. In doing this we must also take into consideration the human element and provide for methods of construction that will, as far as possible, eliminate the personal equation entering into the construction; or, in other words, we should not depend any more than is absolutely necessary, in such an essential matter as this, on perfect workmanship. Mr. Rhoades stated that they did most of their own work, that the same men had been performing this work for a number of years, and that in this way they could secure good results by using the pea stone, as they made it a point to have it only in the bottom of the joint. Where the work is done by contractors, it is better to eliminate the pea stone entirely and avoid the possibility of failure that would occur from bringing the pea stone too high up in the joints, through poor or careless workmanship.

There was also considerable discussion as to the advisa-

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[*] From a paper of the same title presented at the Fourth Canadian and International Good Roads Congress, Ottawa, Ont., April 10-14, 1917.

[†] Chief, Bureau of Highways and Street Cleaning, Philadelphia, Pa.

[**] The abstract of Mr. Connell's paper, "Recent Practice in Granite Block Pavements," is omitted, the matter which follows this ference mark being that referred to by Mr. Connell as the second part of his Ottawa paper. The paper presented by Mr. Connell at Boston was printed in GOOD ROADS for February 24, 1917, page 133.

FRONT STREET, WORCESTER, MASS.—GRANITE BLOCK PAVEMENT LAID IN 1904.

bility of using a shallow block, that is, a block 3½ or 4 in. in depth. It seems to me that there is little ground for discussion in this respect, as it is intended that the shallow block shall only be used on light or medium traffic streets. We would not select a macadam pavement for a street requiring granite block, nor should you select a shallow granite block for a very heavy traffic street that would naturally require the deeper block.

Some question was also raised relative to the tests for granite blocks. Some cities specify that the blocks shall come from certain definite quarries, or from a quarry that will be acceptable to the engineer. There should be a much different method in stipulating just what the requirements should be than to leave it up to the personal judgment of the engineer. After making an inspection trip of the different quarries and an investigation of stone laid by those quarries, it has been determined to make the test for the Philadelphia specifications as follows:

> Compressive Strength: The granite shall have a compressive strength of 16,500 lbs. per sq. in., except when unusually heavy traffic conditions are to be encountered, in which case the compressive strength shall be 20,000 lbs. per sq. in. It is understood, however, that a strength of only 16,500 lbs. will be required, unless definitely stated otherwise in the proposal. The toughness shall be not less than 8, as determined by the method employed by the United States Department of Agriculture.

WASHINGTON SQUARE AT UNION STATION, WORCESTER, MASS.—GRANITE BLOCK LAID IN 1911.

However, it might be stated that these requirements are not entirely satisfactory. Very extensive studies and tests are being made in Philadelphia at the present time to determine upon new standard tests that will insure satisfactory results. Of course, it must be borne in mind that on streets such as West Street in New York, where you have an enormous amount of heavy steel-tired trucking, it is desirable to use the hardest granite that can be secured, but, at the same time one not so hard that it will be brittle and chip. On such a street it might be desirable to raise the crushing strength to at least 20,000 lbs. However, the New Hampshire and Southern granites that test from 16,500 upward are entirely satisfactory for probably 95% of the streets where it is desirable to use a granite block pavement. The Worcester, Mass., pavements, which have been in service upwards of 15 years, and have had practically no money spent on them for repairs, are of the softer granites and they have proven entirely satisfactory on heavy traffic streets.

Another ordinarily very important point that was emphasized is not to leave any more grout than is absolutely necessary on the surface of the finished pavement. When there is an excess on the surface of the pavement and this grout chips off, it often takes with it a portion of the grout in the joints, and this will develop a weakness in the pavement. This is very important as there was a time not many years ago when it was considered good practice in many localities to smear the grout over the surface of the pavement. Again we might point to the Worcester, Mass., experience, where the best granite block pavements have been laid, and where they have always made a practice of leaving practically no grout on the surface of the pavement.

GROUT MIXER IN OPERATION ON GRANITE BLOCK PAVEMENT—MAIN STREET, WORCESTER.

In this paper, specifications have been quoted, which are more or less standard for the modern types of granite block pavements. In this respect, it will not be amiss to call attention to the fact that the granite block pavement should be further standardized so that all the quarries will be making, as far as possible, the same dimensioned blocks conforming to the several standard specifications, as it is difficult and expensive to train the men at the quarries to cut blocks to conform to special specifications.

Another very important feature was brought out in the statement of Mr. Rhoades to the effect that in Worcester they have recently been placing expansion joints parallel and adjacent to the curbs, beginning at the bottom of the concrete base and going right up through to the top of the roadway pavement on streets having concrete curbs and sidewalks, which, without expansion joints, would make more or less of a continuous and rigid construction. The purpose of these joints is to eliminate the vibration felt in the abutting buildings when heavy loads travel over the pavements.

LAYING GRANITE BLOCK PAVEMENT ON BROADWAY, BOROUGH OF BROOKLYN, NEW YORK CITY.

Great stress was laid in another recent paper on the matter of inspection of the construction work, and it was stated by Mr. Durham, former Chief Engineer of Highways of the Borough of Manhattan, who has had considerable experience in laying granite block pavements, that, in his opinion, it was more important, with this type of pavement than with any other, to have inspectors who appreciated the importance of apparently trivial details in connnection with the inspection of the block and the performance of the construction work. These details appear unnecessary to the average constractor, and would to the average layman; but slight neglects in the performance of the work are the principal causes for failures in granite block pavement construction.

LAYING GRANITE BLOCKS ON BEDFORD AVENUE, BOROUGH OF BROOKLYN, NEW YORK CITY.

Granite block not only has its place on city streets carrying heavy trucking traffic, but, as has been stated, the modern, fine dressed, smooth granite block pavement is also suitable for automobile traffic, and the shallow 3½ in. block is very desirable for heavy traffic on suburban and country roads. When we speak of heavy traffic roads, it might be well to call attention to the fact that there is a wide difference of opinion as to what constitutes heavy traffic on a suburban or country road. Some engineers call 400 or 500 vehicles a day heavy traffic. While this may be heavy traffic from the standpoint of the roads coming under their respective jurisdictions, or for the type of pavement they are referring to, yet this number of vehicles today should not be termed heavy traffic. In this connection it is very important that we should all talk in the same language in discussing the terms "heavy," "light" and "medium" traffic. We should either discuss it with reference to different specific types of pavements or in terms of traffic itself. Now, for example, on many roads in the outlying districts 500 vehicles a day would be heavy traffic for certain sections of the country, and also for the type of pavement used, while this number of vehicles would be comparatively light traffic for the main trunk lines between or entering the larger cities. Traffic of 3,000 or 4,000 vehicles a day is very common on the main trunk lines within 30 and 40 mi. of some of the larger cities in the country, and it is on such roads that the shallow 3½-in. granite block pavements will eventually be used, for, while the traffic today on some of these roads may be 4,000 vehicles a day, at the rate of increase for the past six years in the output of automobiles, this traffic will consist of 8,000 vehicles a day in two years from now. As a matter of fact, the fine dressed granite block pavements are used today on a number of grades on the suburban and country roads in the city of Philadelphia. Each type of pavement, however, has its place. The shallow granite block is adapted to certain heavy traffic roads near or in suburban districts of the larger cities.

A very important matter in the construction of granite block pavements is the proper ramming of the blocks. Where the specifications do not state the number of rammers that shall be employed to follow up the work to a definite number of pavers you will invariably find that the ramming of the blocks is neglected and that the contractor will employ just enough rammers to slightly ram each block. Of course, the pay for rammers is about $3.50 per day, and the fewer

BROOMING GROUT INTO GRANITE BLOCK PAVEMENT ON BEDFORD AVENUE, BROOKLYN.

the contractor has to employ the cheaper the work can be performed. For this reason, instead of stating that the blocks be thoroughly rammed, it is most important to state the relative number of pavers and rammers that shall be employed, as is stated in the following quotation from the Philadelphia specifications:

> Number of Rammers to be Operated: On all granite block pavement construction the number of rammers to be operated shall be in the proportion of one rammer to every three pavers.

New Hampshire Road Legislation

Several bills affecting highway work in New Hampshire have recently been enacted into laws by the legislature of the state. One of these acts provides for the protection of state roads and prohibits any person or corporation from excavating or disturbing the surface of any state road, trunk line, or state aid road, except in cases of emergency, without the written approval of the State Highway Department. Another bill relates to the removal of obstructions on the roads mentioned. The other measures are those providing for the acceptance of federal aid by the state and for meeting the obligations of the state incident to such acceptance.

A joint resolution has been passed by the Senate and the House of Representatives in General Court, providing that the sum of $400,000—$200,000 for the year ending Aug. 31, 1918, and a like sum for the year ending Aug. 31, 1919—be appropriated for the completion of trunk lines designated as the East Side, West Side, Merrimack Valley, South Side, Rockingham, and the Ossipee-Meredith Roads, and the construction of certain cross-state highways; the sum of $80,000 of the above being made available for such use on May 1, 1917, if approved by the Governor and Council.

Delaware Law Creates State Highway Department

By the recent enactment of a law creating a state highway department in the State of Delaware, authority is given to establish a system of highways and to appropriate and borrow money for their construction and maintenance.

By the terms of the law the state highway department will consist of the governor of the state and four members appointed by him on or before May 1, 1917. They must be citizens of Delaware, one a resident of the City of Wilmington, one a resident of New Castle County outside of that city, one a resident of Kent County, and one a resident of Sussex County, the term of office of the first appointees being, respectively, two, four, six and eight years. Thereafter all appointments will be made for the full term of eight years, except in the case of vacancy, which the governor must fill for the unexpired term. Not more than two members may at any time belong to the same political party, and they must receive no compensation for their services other than actual expenses incident to conducting the affairs of the department.

The law requires that within 30 days after their appointment and at a date fixed by the governor the members must convene and organize by electing one of their members chairman, and that as soon thereafter as practicable must employ a chief engineer for a term not exceeding one year. The one so employed must be a civil engineer, not under 30 years of age, who has been in active practice of his profession for 10 years, and has had responsible charge of road engineering work for at least 5 years and is qualified to design as well as to direct such work. Graduation from a school of engineering of recognized reputation is to be counted as equivalent to two years of active practice. The salary of the chief engineer is fixed at not over $7,500 a year.

The state highway department must also employ a secretary at a salary not to exceed $3,000 a year, and upon the recommendation of the chief engineer employ professional or technical experts, assistants, clerks, employees and laborers, and such advisors or consultants as may be required to accomplish the purposes of the act.

It is made the duty of the department to acquire complete information concerning the highways of the state and the nature and needs of each, the character and amount of traffic thereon, and other details necessary for laying out and "establishing such a consistent, congruous, comprehensive and permanent system of highways along the route or routes of travel as will accommodate the greatest needs of the people of the state," and, as expressly provided, "without regard to any personal advantage or disadvantage or bias toward any person or persons, community or political party or organization." The state highway department is charged with the duty of constructing or reconstructing the state highways in a manner that with reasonable maintenance will insure their permanence, and of maintaining all state highways under its jurisdiction.

For the purposes of the above the chief engineer is directed to immediately prepare or acquire surveys, maps and plans of the roads of the state and other information for laying out a highway system, and not later than Dec. 31, 1917, to recommend to the state highway department a program of improvement and its probable cost, showing the roads that should first be converted and those that could be constructed during the succeeding year. The chief engineer must make such recommendations annually thereafter. He is given charge and supervision of all engineering work done under the department and the execution and performance of all contracts, upon which his decision is final. He is also to act as consulting engineer for the county road engineers whenever so required by the department.

The new law provides that all materials and labor furnished for the department in excess of a probable cost of $500 shall be supplied or performed under contract awarded on competitive bidding, except in connection with state highway maintenance, or an unusual emergency where damage would result from delay. Contracts must be awarded to the lowest responsible bidder, "unless in the opinion of all the members of the department and the chief engineer the interest of the state shall be better served by the awarding of contract to some other bidder, which may then be done, provided the department shall set down in its minutes the reason or reasons" therefor.

An appropriation for the uses and purposes of the department during the year 1917 is made of all moneys received under certain sections of the revised code relative to motor vehicle registration and licenses in 1917, excepting $50,000. Annually thereafter all moneys so received are to be appropriated for the above purposes, and are to constitute a cumulative road fund not returnable, if not used in any one year, to the general fund. But from the moneys so appropriated the state treasurer must annually deduct an amount sufficient to pay the interest on all bonds issued under the provisions of the act, and an additional 2½% of the amount of said bonds for the liquidation of the principal.

The law requires the preparation of an annual budget 30 days before Dec. 31, showing the estimated revenues available from all sources and the probable requirements and expenditures for state highway work during the succeeding year; and it further provides, in case of excess revenue, for the borrowing of money for the construction of state highways. No amount, however, "shall be borrowed greater than an amount which such excess of revenue will pay the fixed charges on such highways as it is proposed to construct or reconstruct from the proceeds of the bonds proposed to be issued."

Another act was passed by the General Assembly of Delaware authorizing Sussex County to borrow $1,000,000 for the permanent improvement of certain highways in the county, and to issue bonds for that purpose.

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Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

APRIL 28, 1917.

CONVICT LABOR FOR ROADS

At this time when the nation is in need of whatever services its people can render and the labor shortage is greater than it has been in years, the subject of convict labor on roads is most timely. In one of the articles in this issue, the workings of the convict labor plan in Virginia are described, and, as most readers of "Good Roads" are aware, it has been found effective and economical in almost all cases in which it has been tried.

As engineers, road builders quite naturally first look to the economic phases of convict labor, perhaps even to such an extent as to partly lose sight of the human and social phases of the matter. From the economic point of view there can be little if any reason for failing to use prisoners in road building. In almost every state prison labor has been used to some extent in the actual building of roads or in operations incident to road work. While the details of administration, organization, financing and prosecuting the work have differed, the results achieved have been very generally successful. There has been a certain amount of opposition to the plan on the ground of competition with free labor, but it has seldom been justified by the facts. The projects for which prisoners have been used have generally been those which it would have been impossible to undertake had it been necessary to utilize free labor. In the present state of the labor market this objection must lose whatever weight it may have had under normal conditions. In the existing crisis, also, the increased need for the conservation of all resources should make even more apparent the needless extravagance of maintaining convicts in idleness.

The humanitarian and sociological arguments for prison labor are—or should be—even more potent than those of a purely utilitarian nature. The punishment of the offender against the laws should be the last object of society when it imprisons him. First should come the protection of society and then the reformation of the offender. The former can be assured by mere confinement in a prison; the latter cannot. It is admitted by most penologists of broad experience that upon release from the average penal institution the man who has been confined is a worse man, physically, mentally and morally, and more of a danger to society than he was when he entered. It is almost certain that, lacking the incentive and perhaps the ability to earn an honest living, he will drift back into crime, to eventually become a convict again. If, on the other hand, the convict is put out in the open to work on the road he can be given every opportunity to finish his term in better health than when he began it and with his self-respect restored, a start toward a decent life and perhaps an ability to do useful work that he never had before.

And in the meantime, instead of being a heavy charge on the taxpayers, he has contributed to the wealth and prosperity of his country.

ROADS AS WAR MEASURES

There has been evidenced during the past months an increasing realization of the necessity for including road improvement in any comprehensive plan of preparedness and, during the past weeks, a similar awakening to the absolute necessity of roads as war measures. Most of what has been written and spoken on the subject, however, has contemplated the use of the roads for strictly military operations—that is, for the movement of troops and equipment and the transportation of munitions and other war supplies. While this is naturally the first use that suggests itself, there is another that is of quite as great importance—the transportation of the ordinary food supplies of the country.

A considerable portion of the cost of food of all kinds is chargeable to transportation and such shortages as have occurred also have been due in large measure to this same cause. The instances are not few in which the small farmer or fruit grower has wasted the surplus of his farm or orchard over and above that required for his own consumption and for the local market because he could not sell it for enough to pay for harvesting. Often at the same time there has been a decided shortage of these same products in comparatively nearby markets and those obtainable have brought extremely high prices. In almost every such instance the cause may be found in the cost of transportation. Of course, not all of this cost is chargeable to poor roads, but it could be very materially reduced by better roads from the farms to shipping points.

It seems evident from the information now at hand that one of the big problems of the war upon which this country has entered will be the production of sufficient food to take care of home consumption as well as to make large exports. Various plans—some of which, unfortunately, are chiefly remarkable for their lack of practicability—have been suggested for increasing the production of foodstuffs, and it is probable that among the multitude of plans suggested there will eventually be found something definite that will accomplish the desired result. But regardless of how satisfactorily the problem of increased production may be worked out, it will fail of its end unless there are also provided the means of bringing the products of the fields and orchards from the producers to the consumers. Many of the usual difficulties attending the marketing of produce will be made greater by the conditions that probably will obtain. Car shortages may be much greater because of shipments of munitions and other supplies to seaports to be carried abroad; motor vehicles, formerly available for the transportation of foodstuffs, may be pressed into service for other purposes; the possibility of a labor shortage greater than in previous years is indicated, and there have been indications in some instances of decreased activity in road building.

It will, therefore, be necessary to make special provisions for the transportation of produce of all kinds, and much of this must be in the nature of road improvement. So far from being a reason for less activity in road improvement, the war makes advisable and even necessary an increase in the amount of such work and, above all, emphasizes the necessity for better planning and more efficient and economical construction.

This work furnishes abundant opportunities to highway engineers to serve their country in the capacity in which they can render the most efficient service, for the work can be done better by them than by any one else and indeed must be done by them if the best results are to be otained for the least outlay.

The Selection, Operation and Maintenance of Road Building Machinery

Valuable suggestions on selecting suitable road building machinery, on its operation, and on its care were given in one of the papers presented at the Fourth Canadian and International Good Roads Congress, held early this month at Ottawa, Ont. The paper was entitled "Modern Road Making Machinery; Its Selection, Use and Care," and was presented by W. Huber, Assistant Engineer of the Ontario Department of Public Highways. Mr. Huber has written a number of papers on various phases of road work, several of which have been printed in "Good Roads."

Early in the paper Mr. Huber points out that the success attending the use of machinery in road work depends primarily on intelligent selection, competent operation and careful maintenance. The kind of machines to be employed must be given careful study, for equipment once used cannot be disposed of it found unsuitable except at a heavy loss, so that initial mistakes should be carefully guarded against. In operation, proper prosecution of the work and care of the machinery demand the best of operators, for while various phases of the construction of country roads may be classed as rough work, they require a considerable amount of skill and intelligence, without which, even the best equipment cannot be expected to yield satisfactory results. Moreover, machinery, especially road building machinery, begins to deteriorate as soon as it is put to work. It is used in dust and dirt, is exposed to all kinds of weather, and is subjected to rough handling. Unless it is carefully maintained its capacity will be reduced and at the same time its cost of operation will be increased.

The ordinary operations in the construction of country roads are divided by Mr. Huber into grading, quarrying, crushing, hauling, rolling and watering, for each of which up-to-date machinery is available. The first machine used is generally the grader, and Mr. Huber believes that whenever possible the tractive power should be furnished by a mechanical tractor. The operating costs of a steam or motor tractor are approximately equal to the wages paid for two teams while the work accomplished by the tractor is from 25 to 50% more. He also points out that where the mechanical tractor is used the heavier graders should also be employed.

When local stone is used in the construction of a road, Mr. Huber states, the usual practice is to place the material immediately after crushing, and this means that the crusher and roller are expected to work together. Economy and efficiency demand that the stone be rolled and finished as soon as it is placed on the road and that both crusher and roller be worked to capacity, care being taken that the roller is not rushed to such an extent as to create a tendency toward half finished work. A common source of loss in crushing, according to Mr. Huber, is the use of a crusher of too small capacity. He holds that the daily output of a crusher with a jaw opening of less than 9x16 or 10x18 in. has been found too limited for the average road building outfit. Care should also be taken that the motive power is sufficient to drive the machine at full speed with a full load. He believes that when a portable or traction engine is used it should be of not less than 20 hp. Among the points emphasized by Mr. Huber in connection with the operation of the crusher are to avoid the breaking of large pieces in the jaws with a sledge, to block the crusher up off its wheels to reduce the vibration and prevent unnecessary wear on the axles and to pay special attention to the lubrication. He does not favor the use of automatic oiling devices, stating that good lubrication is better assured by the frequent application of small amounts of oil from an ordinary oil can. A heavier grade of oil should be used on hot days than on cold days and the oil used should be of such character as to retain its fluidity in cold weather.

In regard to the selection of screens for separating the sizes of crushed stone used for road work Mr. Huber believes that two screens furnishing three sizes are advisable, the sizes of the perforations depending on the stone. For limestone he recommends 3-in. and 1¼ or 1½-in. openings, while for granite or trap rock he prefers 2½ and 1-in. openings. He states that the use of three screens having openings approximately 3, 1½ and ¾ in. is a bad practice, as it gives four sizes of stones, including a size varying from ¾-in. to 1½-in. which, when used by itself, is more detrimental than useful.

The intelligent selection of a roller, according to Mr. Huber, requires the careful consideration of several points. A 12-ton roller is recommended for use on old gravel or stone roads, which furnish a firm foundation. On roads that have not previously been metaled or where the soil is not firm a 10-ton machine will give better results. If a steam roller is used, it should be one of the double cylinder engine type, as the greater smoothness with which it runs, its ability to start from any position and various other points of superiority fully justify the slightly greater cost.

As the greatest wear on a roller, according to Mr. Huber, is on the rear rolls, machines with detachable rims are advantageous. A machine with a low center of gravity is also preferred by Mr. Huber because of its greater stability which is particularly apparent when it is used on steep earth shoulders in wet weather.

As the roller is the limiting factor in the plant, according to Mr. Huber, it should be worked to capacity, suiting the other operations to the capacity of the roller. For this reason it is best to secure the most capable operator obtainable, first to get the greatest amount of effective work from the machine and second to keep the machine itself in the condition of maximum efficiency.

In reference to the operation of rolling, Mr. Huber points out the necessity for rolling the stone as soon as possible after its delivery to the road, the necessity for confining the stone at the sides and the desirability of keeping the roller operating continuously.

As a large part of the work and expense of road building is in the transportation of materials, Mr. Huber points out that any considerable saving in hauling costs will materially reduce the cost of the finished road. Team haulage, he holds, is fast losing its importance because of the increase in the price of teams. He places the cost of team haulage at between 20 and 40 ct. per yd. mi. with an average on country roads of from 25 to 30 ct. Under very favorable conditions, traction haulage, according to Mr. Huber, has cost less than 5 ct. per yd. mi., while a fair average would probably be from 8 to 12 ct.

Low traction haulage costs, Mr. Huber points out, depend on the selection of the equipment most suited to the conditions under which the work is to be done and the careful operation of the machinery and upon organizing and planning the work in such a way as to eliminate delays. One of the common mistakes in purchasing hauling equipment, he holds, is the selection of equipment that is too heavy and too large. On country road work, he states, experience has shown that the capacity of the traction wagon should not exceed 3 or 4 cu. yd., as better results can usually be obtained by reducing the size and increasing the number of cars. The reduction of lost time being an important consideration, quick loading is essential, and if loading cannot be done without loss of time, it is necessary to have two trains of cars in order to keep the tractor working.

The motor truck Mr. Huber believes to be the ideal means of transportation on city pavements or over first-class roads, but he believes that the truck has not yet proved the most economical method of hauling under the conditions existing on the majority of Canada's rural roads.

Mr. Huber condemns as inefficient, extravagant and dangerous the practice of intrusting the general care and repair of a machine to its operator, and recommends placing the responsibility for the condition of the entire outfit on a capable master mechanic. The duties of this member of the organization should include frequent inspections of the machines both in operation and at rest, the acquiring and storing of a sufficient stock of repair parts, and the supervision of all repair work. He also points out that the care of machinery when not in use is almost if not quite as important as its care while in operation. He points out that a few months' exposure to the elements or to conditions promoting rust will result in a greater depreciation than a whole season's use, and urges proper protection of the machinery when idle.

Summing up, Mr. Huber states, that to give the best returns machinery must be "exactly suited to the work it is doing, it must be operated by competent men who know how to get results from it, it must be operated without loss of time, and it must be kept under experienced supervision and carefully maintained."

Highway Legislation in North Carolina

The general assembly of North Carolina passed at its 1917 session a general law applicable to all the counties of the state, providing for the improvement of public roads. The act relates specifically to the issue of bonds and to county highway commissions.

A measure was passed giving to the state highway commission the use of funds derived from automobile taxation for the maintenance of the main highways of the state. Other legislation directs county commissioners to have guide posts erected at the forks and crossings of public highways in the several counties, and makes it a misdemeanor to erect an advertising sign resembling the warning signs used at railroad crossings.

In a special act relating to the handling of prisoners in the state, their use on road work is regulated.

The law providing for bond issues for road improvement gives authority to the board of county commissioners, upon the petition of 100 freeholders of the county, stating the amount of bonds it is proposed to issue and the number of miles it is proposed to improve, to order an election at the next election of county officers, or within 30 days from the date of such order, provided that the written endorsement of the state highway commission that the amount of bonds proposed to be issued will be sufficient to construct or reconstruct the approximate number of miles proposed to be improved is first given to the board of county commissioners; and provided that the maximum amount of bonds "together with all the bonds previously issued and remaining unpaid by such county, shall in no case exceed an amount equal to 10% of the total assessed valuation of the county."

The funds derived from a bond issue for road work in the various townships composing the county, in proportion to the assessed valuation of each township, are apportioned accordingly, "the intention being that each township shall receive and have expended for its benefit, a fair and equitable proportion of the money arising from the bond issue authorized by this act."

A similar provision is made for levying a special road tax, which must not "exceed 50 ct. on the $100 worth of property according to the last tax list, and $1.50 on the poll, observing at all times the constitutional equation."

If a county fails within three months after the passage of the act, to take advantage of the provision made for issuing bonds or levying a special tax, any township within such county may take steps to do so upon a petition of 25 of its freeholders and in the manner prescribed for counties. In any case the action must have the approval of the state highway commission. The same rights and privileges are granted to road districts.

Respecting the maintenance of roads, the law provides that when bonds have been sold or a special road tax levied the board of county commissioners or other body having control of county road wrk must levy an additional special maintenance tax sufficient to produce an amount not less than 1% nor more than 4% of the par value of the bonds or of the amount of the special road tax to be used for the purpose of maintaining the roads built through the expenditure of the funds so raised.

A county road commission may be created upon the petition of 100 freeholders of any county, submitted to the board of county commissioners who will proceed to call an election at the regular election of county officers or at any other time not less than 30 days after the date of the order, and a majority of votes cast in favor of the commission will have the effect of creating it.

The act provides that "Whenever a bond issue or a levy of a special road tax or the appointment of a county road commission is authorized as hereinbefore provided in this act, there shall be and there is herewith created in such county, except as hereinafter provided, a county road commission to be composed of three members, one of whom shall be at all times a member of the minority political party of the county, and who shall be appointed by the board of county commissioners. In making the first appointments one member shall be appointed for two years, one for four years and one for six years." If the petition states that the board of county commissioners shall have charge of the highway work in the county, a new county road commission will not be appointed.

The commission elects its chairman and secretary biennially, and constitutes a corporate body. It is charged with the work of laying out, constructing and maintaining all highways in the county, except in the case of bond issues or tax levies that are applicable only to a township or road district.

Authority is given to the commission to employ an expert road engineer who may consult the state highway engineer whenever desirable. Where convicts are assigned to county or township highway work, they are under the control of the county road commission.

The road commission or board in any county is directed to furnish to the state highway commission the number of miles of road built, the type of construction, number of bonds sold, amount of taxes levied, and all other information relating to highways that the commission may require. The members of the county road commission are authorized to attend the annual road institute at the University of North Carolina, and to require the attendance of any persons connected with the road work in the county, the expenses of members and others to be paid by the county, township or road district represented.

A road district may be created upon a petition of 25 freeholders of the area of the proposed district under a plan similar to that providing for bond issues or the levying of taxes.

A special road district may be created upon a petition signed by the owners of 60% of the land adjoining the proposed road improvement. One-third of the cost of the improvement must be borne by the property owners on each side of the road, and one-third by the county.

Roads that are constructed or improved under the provisions of the act must be maintained by the county road commission or other body charged with the duty of administering the public road matters of the county.

The act relating to the regulation of prison labor, requires that all use of such labor on the roads of the state must be under the direction and supervision of the state highway commission.

Road Maintenance in Minnesota*

The experience of the past two years has been that funds provided for maintenance are not sufficient, and this brings out the necessity for providing an adequate maintenance fund or decreasing the state road mileage. When a road is established as a state road the county assumes the obligation of maintaining it as required by the Highway Commission, and if this cannot be done with the funds available the less important roads must be abandoned as state roads and turned back to the towns for maintenance.

It is a mistake to assume that only sufficient county money should be set aside to meet the state aid appropriation for maintenance. This should not control in any way. The county should make a survey of its maintenance problem and provide sufficient funds to permit the highway engineer to carry on the maintenance work in such a manner that the road will be in good condition at all times. This is what the people expect and is what the Highway Commission will demand of the counties before making final settlement on their state aid.

The average cost for maintenance on the whole state road system is about $60 per mi. per year; this is sufficient to take care of the repairs and dragging on roads having light traffic, but is not enough to provide for the satisfactory maintenance of important state roads. On some of the gravel surfaced main roads it is found that in addition to the ordinary maintenance such as dragging, reshaping, keeping drainage open, etc., there is an actual loss of not less than 100 cu. yd. of gravel per mi., due largely to rapid motor traffic. As there is a large mileage of graveled road in this state, it becomes necessary to provide some means for maintaining this surface and saving the surfacing material, which is rather expensive in many localities. Experiments and investigations prove the value of bituminous material to hold a gravel surface in place, and it is expected that a considerable mileage of state road will be given surface treatment in 1917. Road authorities are cautioned not to purchase "road oils" without regard to their suitability for the purpose intended. There is a great difference in the so-called road oils, some of which may be used to very good advantage in waterproofing an earth road, while the same material would do more damage than good to a gravel road for the reason that, instead of binding, the surface would become lubricated on account of the oily consistency of the application, but there are many satisfactory surface binders which may be used for the preservation of gravel roads. The advantage of surface treatment is not only in the saving of maintenance, but decreases the dust nuisance found so objectionable on the main highways.

The organization of maintenance forces in Minnesota is principally along the lines of the patrol system, which has been found most satisfactory, particularly on surfaced roads. The sections vary from 4 mi. to 12 mi. in length, with a road patrol in charge of each section. A patrol is required to furnish a team with wagon and hand tools, and is supplied by the county with a light grader and road drag. Authority is given to the patrol to employ extra help for dragging and emergency repairs when needed, and patrols are held personally responsible for the condition of the road surface within limits of their sections. This system will undoubtedly be generally adopted on surfaced roads for its efficiency has been proved.

Improvement of Philadelphia Roads Asked

For the purpose of urging the improvement of certain state highway routes leading out of Philadelphia in view of any emergency that might arise in connection with the transportation of troops or military supplies, representatives of the Chamber of Commerce recently called upon Commissioner Black of the Pennsylvania State Highway Commission, at Harrisburg.

The Commissioner stated that the department could not promise improvements calling for extraordinary expenditure in any particular section of the state, and explained the policy of expending appropriations among the counties in proportion to the mileage of unimproved roads in each county. More than 20 counties in the state have agreed to assume one-half of the cost of constructing any new road within their respective boundaries.

In the event of a special appropriation being made for the building of military highways the department would be ready, it was stated, to accomplish the work as speedily as possible.

NEWS NOTES

Brick Paving to Be Constructed in La Crosse, Wis., will extend over 30 blocks and cost $100,000, according to a report.

The Placing of Advertising Signs on bridges and culverts in Nebraska is illegal, and is punishable by a fine of not over $100, with imprisonment until the fine and costs are paid.

The County Commissioners of Sussex County, Delaware, have recently purchased 20 new 8-ft. drags, of the Russell type, for use on the earth roads in various sections of the county.

The Paving of Nine Streets in Green Bay, Wis., was recently ordered by the City Council. Bids will be received on four materials, sheet asphalt, reinforced concrete, brick and creosote block.

Hillsborough County, Florida, is planning to expend $609,000 for 54 mi. of vitrified brick, asphalt block, or other hard surfaced roads. Two bridges on the Bayshore Road are to be built also.

The Municipality of San Juan, Porto Rico, by a recent issue of bonds that were purchased in the United States, has provided $412,000 for opening and paving its streets, according to a consular report.

The Highway Bridge Over the Mississippi River at Memphis, Tenn., is to be formally opened to traffic on May 22, 23 and 24. Plans are being made for an elaborate program of entertainment for visitors, including a water pageant and masque. The bridge will cost $8,000,000.

The Name of the Bowery in New York City will be changed if the Manhattan Bridge Improvement Association is successful in its effort to have this thoroughfare called "Peter Cooper Avenue" or other suitable name. It is claimed that the development of new business in the vicinity is greatly hindered by the stigma which is alleged to have formerly attached to the word "Bowery."

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*From the 1915-1916 report of the Minnesota State Highway Commission.

MEETINGS

Calendar of Coming Meetings

May 7-9.—National Conference on City Planning—Annual Conference, Kansas City, Mo. Secretary, Flavel Shurtleff, 19 Congress St., Boston, Mass.

May 8-9.—Institute of Paving Brick Manufacturers—Convention St. Louis, Mo. Secretary, H. H. MacDonald, 830 B. of L. E. Building, Cleveland, O.

May 23-24.—Michigan State Good Roads Association—Annual meeting, Saginaw, Mich. Secretary, A. A. Anderson, Hastings, Mich.

June 11.—New York State Conference of Mayors and Other City Officials—Annual Conference, Buffalo, N. Y. Secretary, W. P. Capes, 25 Washington Ave., Albany, N. Y.

June 26-30.—American Society for Testing Materials—Annual meeting, Atlantic City, N. J. Secretary, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

North Carolina Good Roads Association

It has been decided by the officers of the North Carolina Good Roads Association to hold the annual meeting at Asheville, N. C. No date has been fixed for the meeting, but according to reports it will probably be held some time during June. The Secretary of the association is Dr. Joseph Hyde Pratt, Chapel Hill, N. C.

United States Good Roads Association

The fifth annual convention of the United States Good Roads Association closed at Birmingham, Ala., on Friday of last week, having been in session four days.

At the opening of the convention on Tuesday, the 17th, Vice President John W. O'Neill presided. Governor Henderson, of Alabama, in a brief address of welcome on behalf of the state expressed an unqualified interest in the cause of good roads. Commissioner J. D. Truss, of Birmingham, welcomed the delegates to the city. Other addresses were made by representatives of civic bodies and road organizations. In the absence of Charles H. Davis, of Cambridge, Mass., President of the National Highways Association, his address was read by Capt. John Craft, President of the Alabama Good Roads Association.

A review of the activities of the association was presented in the report of Secretary J. A. Rountree, of Birmingham, which was followed by the appointment of committees on resolutions, national highways and nominations. As a part of the first day's program the delegates and guests were taken in automobiles over the city and district by officials and residents of Birmingham and Jefferson County, and in the evening a reception was given them at the Tutwiler Hotel, followed by a theater party.

U. S. Senator John H. Bankhead, President of the association, was present on the second day of the convention and spoke on Alabama's progress in road work, expressing the opinion that highway development in the United States was the greatest question confronting the nation. Governor Charles H. Brough of Arkansas gave an interesting talk on the road situation in that state. Judge T. E. Patterson, Chairman of the State Highway Department of Georgia, declared that the use of convicts on the roads had solved the labor question to a great extent in Georgia, and that he believed their use throughout the United States would not only benefit the convict, but would aid in solving the question of road improvement. A number of other addresses including illustrated lectures on road topics by men well known in the work of highway development occupied other sessions of the convention.

A banquet in honor of the governors and other distinguished visitors was given at the Tutwiler Hotel on Wednesday evening.

The nominating committee made the following report of officers for the ensuing year:

President, Senator John H. Bankhead; Firse Vice President, Governor Charles H. Brough, of Arkansas; Second Vice President, E. J. Watson, Columbia, S. C.; Third Vice President, John W. O'Neill, Birmingham; Secretary-Treasurer, J. A. Rountree, Birmingham.

Michigan State Good Roads Association

Announcement is made of the ninth annual convention of the Michigan State Good Roads Association at Saginaw, May 23 to 25, and in connection therewith a school of road building instruction to be conducted by the State Highway Department. A special effort will be made to secure the attendance of the 1,500 road commissioners of the state. A new law provides that they shall receive payment for their time and expenses.

The meeting will be held in the Saginaw Auditorium, which has a seating capacity of 4,000, and affords ample space for exhibits. No charge will be made for space to exhibitors. Outside space will also be provided for road making machinery in operation. Hours for viewing the exhibits will be from 7:00 to 10:00 a. m., 12:00 to 2:00 p. m. and 4:00 to 6:00 p. m. each day.

David A. Nicol, of Saginaw, is Chairman of the Committee on Arrangements, and Langley S. Foote, of Saginaw, is Secretary.

PERSONAL NOTES

A. T. Thompson was recently appointed City Engineer of Grand Rapids, Wis.

W. J. Fulton, recently City Engineer of Gary, Ind., has been promoted to the presidency of the Board of Public Works of that city.

George C. Diehl has been reappointed County Engineer of Erie County, New York, for a term of four years, at a salary of $3,000 a year.

J. G. Scrugham, Dean of the Mechanical School of the State University, has been appointed State Engineer of Nevada, succeeding William Kearney.

W. A. Rowell has been made City Engineer of Rensselaer, N. Y. He was formerly connected with the engineering department of the New York State Commission of Highways.

L. G. Burrell, who became Bridge Engineer of Wyoming County, West Virginia, last fall, has resigned to take charge of highway construction in Barker District, Balbour County, that state.

W. P. Cottingham has been appointed City Engineer of Gary, Ind., succeeding W. J. Fulton, promoted.

E. L. Burridge, of Crystal Falls, Mich., has been re-elected president of the Upper Peninsula Highway Engineers' Association.

C. S. Leftwich has resigned as Borough Engineer of Boroughs of Middletown and Royalton, Pa., to enter the employ of the Bethlehem Steel Co. as engineer in the claim department.

Reid Tull, of Spartanburg, S. C., has been elected County Highway Engineer of Spartanburg County. He will receive a salary of $3,000 a year, and will have charge of road work under the $1,000,000 bond issue passed in that county.

C. R. Richards, Professor of Mechanical Engineering, has been appointed Dean of the College of Engineering and Director of the Engineering Experiment Station of the University of Illinois to succed Dr. W. F. M. Goss, who is now president of the Railway Car Manufacturers' Association of New York. Prof. Richards is a graduate of Purdue University, 1890, and has been head of the Department of Mechanical Engineering of the University of Illinois since 1911. He is a member of the American Society of Mechanical Engineers and other engineering bodies.

PUBLICATIONS

THE KINGSHIGHWAY. A report by the City Plan Commission of St. Louis, Mo. Paper, 6x9 in., 8 pp., inset map.

In this report is a review of the work done to date in the improvement of the Kingshighway with a discussion of the proposed additional work. The inset map shows the route of Kingshighway and is printed in three colors, the improved parks and boulevards being shown in green and the proposed work in red.

MINNESOTA STATE HIGHWAY COMMISSION. Report for the years 1915 and 1916. Paper, 6x9 in., 40 pp., illustrated, inset map and tables.

This report includes a brief statement on the progress of the work with special sections on federal aid, bond issue road work, maintenance, safety on the highways, new cellular slab bridge design, concrete pile trestle bridges, bridge supervision, and other topics, and a number of tables showing details of the work of the department. The inset map is a large scale map of the state showing the status of bridge construction by means of red dots indicating bridges for which plans were furnished by the state highway commission. The report is accompanied by another large scale map showing the status of state road construction. On this map, surfaced and graded state roads are indicated by red lines, graded state roads by light blue lines, uncompleted state roads by yellow lines and impassable state roads by broken red lines.

COLORADO STATE HIGHWAY COMMISSION. Fourth biennial report, for the period from Dec. 1, 1914, to Nov. 30, 1916. Paper, 6x9 in., 126 pp., illustrated, inset tables, pocket with map.

This report includes the general report of the State Highway Commissioner and a report by the secretary-engineer of the commission, together with a large amount of tabular matter showing details of road work in the state. An inset table carries data on expenditures on state roads during 1915 by the state and the counties, and similar expenditures on county roads by the counties. A second table carries corresponding figures for 1916. In a pocket on the back cover is a road map of the state showing in colors the status of road work. Surfaced state highways are shown by full red lines, improved unsurfaced state highways by full blue lines, unimproved state highways by broken blue lines. The official numbers of roads in the state highway system are printed in large red figures. The map also shows the highway commissioners districts, their outlines being indicated by green lines and the numbers by large green figures. The illustrations in the report consist of halftones, most of them of full-page size, showing improved roads, roads under construction and bridges.

CONNECTICUT STATE HIGHWAY COMMISSIONER. Biennial report for the term beginning October 1, 1914, and ending September 30, 1916. Paper, 6x9 in., 103 pp., illustrated, inset tables.

Included in this report are the following: A general statement of the work during the period covered by the report; a detailed report of the finances of the work; a statement showing the details of construction; a statement showing the details of repair work, and an inventory of the equipment owned by the department. The general statement occupies about twelve pages. The report of the finances of the department comprises a number of tables showing expenditures, funds available and similar data. The statements of construction and repair also consist of tables, many of them printed as insets, showing various details of the work of the construction and repair divisions of the department. The report is illustrated by a number of excellent halftones, most of which show bridge work.

"Concrete Highway Construction"

As noticed in the issue of April 21, a new booklet bearing the above title has been issued by the Atlas Portland Cement Co. for the use of road builders. It is obtainable from the Highway Department of the company at No. 30 Broad St., New York, N. Y., instead of 30 Church St., as incorrectly stated in the previous notice.

LETTER TO THE EDITOR

A Statement Relative to Maintenance Costs on the Chevy Chase Experimental Road

Editor "Good Roads":

In your issue of April 21 we note a letter from Mr. J. R. Draney with reference to maintenance costs on the Chevy Chase experimental road which we gave in an advertisement over the signature of this company in your issue of April 7. Mr. Draney says that in order that there may be no "misapprehension," he wishes to state that a particular brand of oil asphalt was not laid on any part of this road, and that "it also might be well to state that none of the so-called oil asphalts referred to in this list were of Mexican origin."

The table given in the advertisement was obtained from the Office of Public Roads. The names of the materials used in the seven experiments were omitted in the advertisement, but since question has been raised as to what these materials were, we beg to state that they were as follows: (1) Tarvia, (2) Tarvia, (3) Bermudez native asphalt, (4) Gilsonite, fluxed, (5) Standard Oil, (6) Texaco, (7) Asphaltoilene.

Mr. Draney may have some inside information as to what Standard and Texaco road binders are made of, but the producers of these materials state that they are made of Mexican oil.

D. T. PIERCE,
Executive Assistant,
Philadelphia, Pa. Barber Asphalt Paving Company.

GOOD ROADS

A Weekly Journal of Road and Street Engineering and Contracting

Old Series, Vol. LI.
New Series, Vol. XIII.

NEW YORK, MAY 5, 1917

Number
18

Results of Improper Street Drainage

By HALDANE WHITE

Approximately $75,000 is the price Portland, Oregon, has paid in the last few years to learn that there is no economy in slighting street drainage. In addition to the municipality's expenditures, private property owners have contributed heavily to the correction of slides in the hilly sections of the city, due in every case to inadequate or improper drainage of storm water. Numerous slides have wrecked streets, retaining walls, bulkheads and bridges, and have threatened and damaged residences.

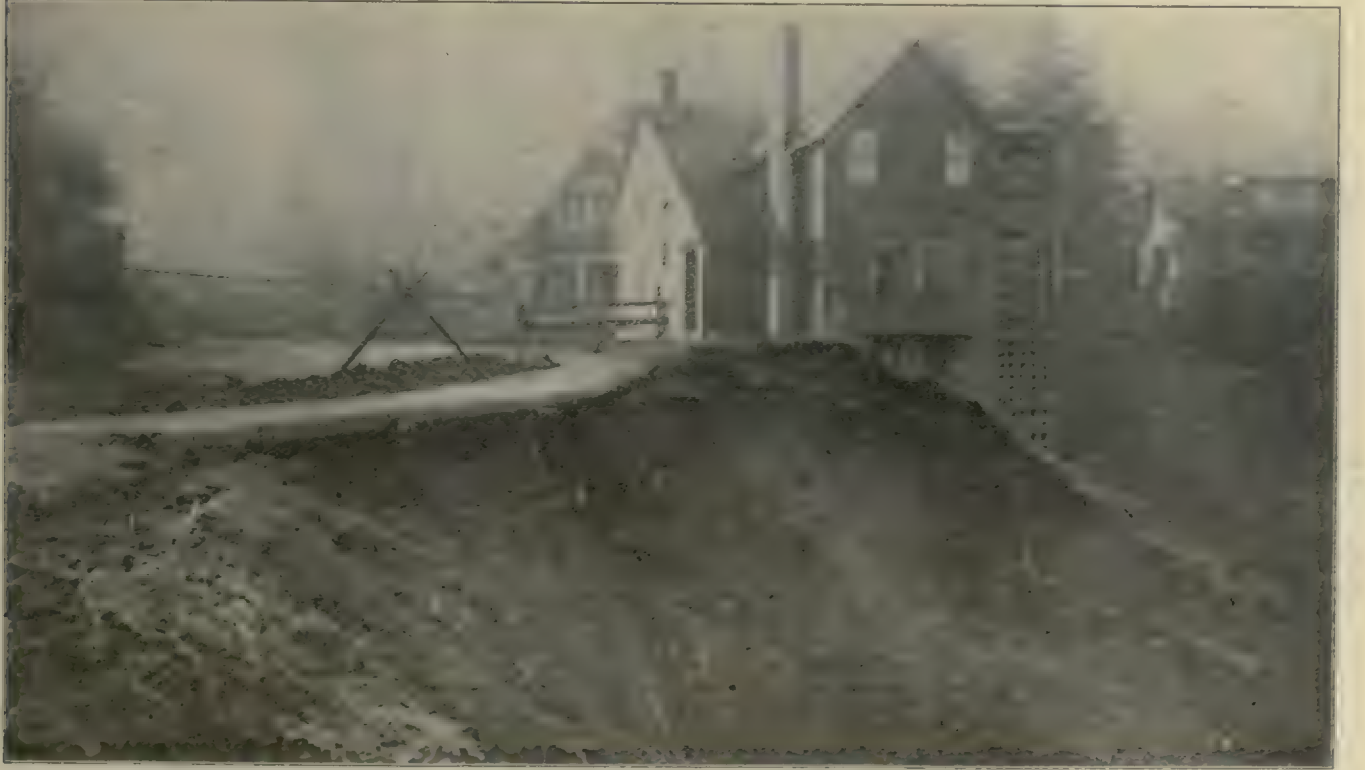
Since these disastrous experiences, drainage has been given the most careful attention in all projects. The preliminary plans for each project now involve a complete survey of the drainage of the entire neighborhood both above and below the street. This is given particularly careful studies in projects involving earth fills.

Various causes have contributed to the slides, according to reports of the Department of Public Works. One has been drainage systems too small to carry away water in heavy storms or thaws; another improperly constructed drainage systems; others drainage systems designed both as to size and location merely for street drainage and not for drainage from abutting property; and still others drain pipes so built that they soon become clogged either with silt or roots.

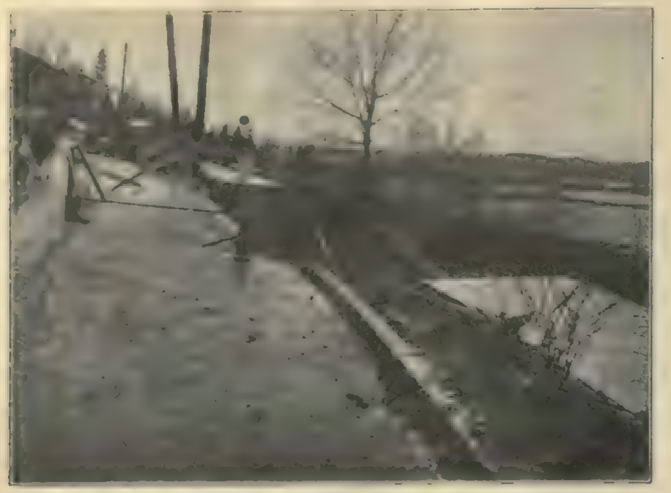
One of the disastrous slides occurred on Thurman St. This carried away a part of the paved street area and entailed a repair cost of $20,000. Only by the most strenuous of efforts was it possible to save several large residences from being undermined and wrecked. The slide occurred at a point where the street had been built on a high fill. Drainage had been provided for the street area but was inadequate for the heavy run-off of water from the area adjacent to the street.

In another case on Montgomery Drive, drainage under the street on a fill at the bottom of a hill failed to find an adequate outlet and in diverting softened the earth of the fill and caused it to give way on one side. The slide took out a part of the street and the earth up to the foundation of a large residence. Another residence on the street was moved several feet out of place and an expenditure of $12,000 was required to put it back in safe condition.

A striking example of improper and inadequate drainage was furnished by the case of the Vista Ave. retaining wall which collapsed during a heavy storm. The wall held up Vista Avenue, a street in a high class residence district. The drainage pipes were too small and were not properly placed. An expenditure of $18,000 was necessary for the rebuilding, which involved an extensive investigation of drainage.



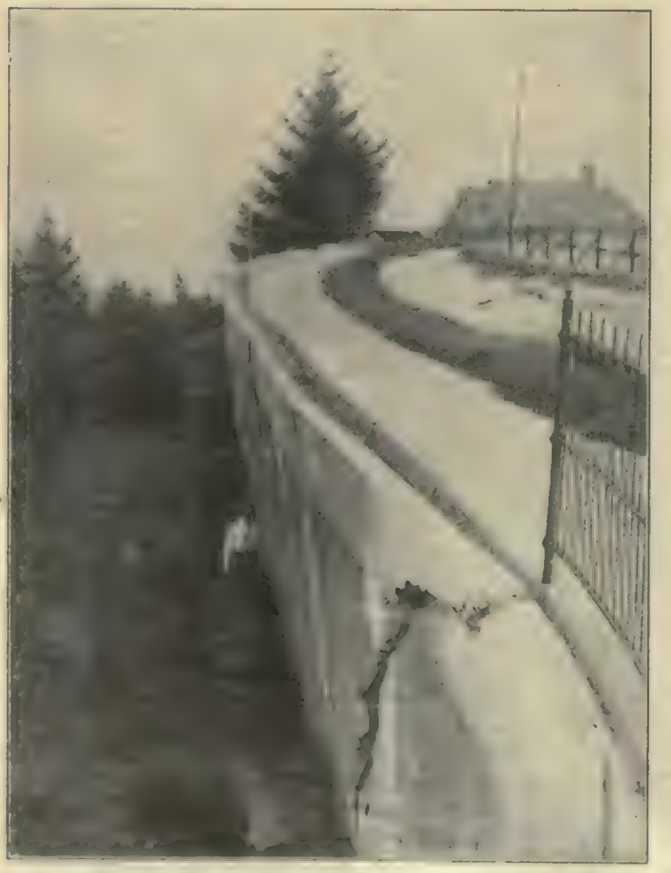
DISASTROUS SLIDE CAUSED BY POOR DRAINAGE—MONTGOMERY DRIVE, PORTLAND, ORE.



SLIDE CAUSED BY POOR DRAINAGE ON THURMAN STREET, PORTLAND, ORE.

In another case, that of Sixteenth St., improper drainage on filled private property as well as insufficient drainage in the street area under a bridge caused a slide that took out the earth up to the foundation of a residence and in sliding down took out a long bridge and partially covered residences with mud.

The practice of covering up old springs has proved disastrous in several instances. In these cases the idea was that these springs would dry up or find an outlet and, therefore, drainage was not provided. In some cases these fills over springs have stood, but in the great majority of cases the ultimate outcome has been collapse. In one case of this sort a whole hillside started to move toward a large hospital. It was stopped by the construction of a drainage tunnel under the moving hillside, at a cost of about $5,000.



FAILURE OF A RETAINING WALL ON VISTA AVE., PORTLAND, ORE., DUE TO IMPROPER DRAINAGE OF FILL BACK OF WALL.

Many other cases have occurred in Portland, all due to lack of proper drainage. The trouble in most instances has come years after construction and under unusual weather conditions.

Plans for drainage are now based on accurate data as to extreme storm conditions and accurate surveys of the drainage area in each case. The systems are then designed to care for a 10 or 15% greater load than the maximum determined by the investigations. Where drain pipes are of large size and designed to carry water from fixed subterranean passages sealed joints are used. In pipes designed to catch seeping water the lower half is cemented at the joints and the upper half left unsealed and covered with straw and gravel. In a number of cases threatened slides have been stopped by the hurried construction of pipes to tap subterranean passages or seeping water.

Rhode Island Provisions for Meeting Federal Aid

In taking advantage of the provisions of the federal road law through legislative action, the State of Rhode Island appropriated from its treasury the sum of $174,985.65 for the reconstruction and improvement of rural post roads that are state roads. A like amount is available from the federal treasury.

Provincial Highway System Law Passed In Ontario

The measure proposing a system of highways for the Province of Ontario, which, as noticed in the issue of March 31, was before the legislature of the province, has become a law. Under its provisions, any highway in Ontario may be assumed, constructed and maintained by the province as a part of the provincial system upon the recommendation of the Minister of Public Works and Highways.

All expenditures for labor, materials and equipment, or for the acquisition of land or property are to be met by what is known as the "consolidated revenue fund" under the Highway Improvement Act, 30% of the cost of construction, repair and maintenance, in most cases, being returnable to the provincial treasury by the municipality or city in which the improvement is made. The province, however, assumes the entire cost of surveys and equipment, and all general departmental expenses and salaries.

The division of expense among several municipalities is made on a basis of mileage unless the engineer in charge should consider such a division inequitable, in which case he may apportion the cost "in such a manner as he deems just and expedient."

The law also makes provision for charging a portion of the cost of construction to the lands adjoining the improvement. When a country road is taken into the system the cost may, whenever equitable, be charged to the county corporation. In the acquisition of a toll road the expense incident thereto is distributable on the basis of 60% to the municipalities benefited.

In the construction or repair of bridges having a clear span of 20 ft. or more, a municipality in which such improvement occurs must pay an amount equal to 60% of what it would have expended in building or repairing a bridge if it had not been taken over by the province, and the same percentage applies to the division of the cost of maintenance as applies to the maintenance of highways.

The class of vehicular or other traffic may be regulated or prohibited on the provincial system of roads by the minister of public highways upon the approval of the lieutenant-governor in council. Authority is given the deputy minister in procuring proper drainage for the highway system to appoint one or more of the engineers of the department to carry out the provisions of the act.

Expenditures for Road Maintenance and Repair in Connecticut[*]

Under expenditures for repairs and maintenance of roads there are two divisions as noted above, namely, the ordinary repairs of roads and the permanent repair of roads; that is, the replacement or reconstruction of existing highways.

The total amount expended for both purposes on trunk lines, after all refunds have been deducted, during the past three years is as follows:

1913-1914	$785,099.34
1914-1915	879,936.44
1915-1916	981,608.73

which totals include all expenditures for straight maintenance and replacements, plus the cost of state aid oiling.

It will be noticed by comparing these figures that the annual total charge for maintenance has increased steadily, but when it is explained that these totals include the amount expended for replacements and a comparison is made between the cost of straight road maintenance for each year the general improvement will be shown.

For example, for straight trunk line road maintenance plus the oiling of state aid roads, there was spent in 1913-1914, after all refunds were deducted, $587,182.58; in 1914-1915, $665,761.70, and 1915-1916, $567,130.17, while for permanent improvement or replacements there was spent in 1913-1914, $197,916.76; 1914-1915, $214,174.74, and 1915-1916, $414,478.56.

It is, therefore, shown that the increase in the cost of replacements has resulted in the reduction during the past year in the cost of straight maintenance. This policy of improving existing highways by constructing hard surfaces should be continued for two reasons—one the general improvement of the highway surfaces, the other that the annual maintenance charge per mile may be eventually reduced.

In connection with the above, when it is known that the cost of labor and material has been extremely high during the past year, the result of the policy of replacing as much mileage as possible with permanent pavement has resulted in a material reduction in the cost of straight maintenance, which has been considered as that portion of the department's expenditures which gives results only temporarily; that is, the expenditure has to be renewed every year.

The above expenditures given for maintenance are those which are made on trunk line highways for which the state pays the entire cost.

In connection with state aid roads, the cost of repairs has materially increased for the last three years as follows: These amounts are gross amounts and are reduced by the refunds received from towns which pay one-quarter of the cost of state aid repairs.

1913-1914	$119,678.73
1914-1915	165,741.54
1915-1916	178,765.68

These totals show an annual increase, because it has been evident that the repair of state aid roads has been done less thoroughly in the past than the repair of trunk lines, because the funds available have been smaller and there is a difficulty in making adequate or extensive repairs when the towns are required to contribute.

The cost of supervision for both state aid and trunk line maintenance is as follows:

1914-1915	$54,084.91
1915-1916	61,856.17

which includes the expenditures for office and field supervision.

There was also spent for repair equipment, including trucks, crushers, rollers, scrapers and other tools, the following amounts:

1914-1915	$24,105.96
1915-1916	55,271.37

It was found necessary to materially increase our equipment in 1915-1916 to offset the scarcity of labor and provide for more rapidity in execution.

The general result of the repair work has shown that it is advisable to replace on many through trunk lines the old macadam or gravel roads with roads of concrete or having a concrete base. Considerable trouble has been experienced the last three years, due to the combination of extrme bad frost conditions and the development of heavy trucking traffic, which causes severe damage to the roads. In one particular instance, namely, the Boston Post Road, the destruction of the surface of the road resulted in an expenditure by the state of $100,000 for new concrete foundations and the corresponding expenditure of $90,000 by the Warren Brothers' Company in the replacing of a guaranteed Warrenite surface, which was formerly built on macadam surface. It was considered wise to replace this broken macadam foundation with a 6-in. concrete base.

The results of such experience show that it is necessary to provide much heavier foundations for pavements on the main traveled roads on account of the material increase in the weight of motor vehicles and also because these motor vehicles use the road continuously, regardless of weather conditions, at times when they cause the greatest trouble. To some extent this increase in weight and amount of motor vehicle traffic is due partly to the concentrated business activities in the state of Connecticut and partly to the inability of the railroad company to handle freight, both of which facts caused increased transportation of freight by motor.

In connection with the discussion of the Repair Department's activities it is encouraging to call attention to the increased amounts annually received from automobile fees. These fees amounted in round figures to $730,000 during the past year; hence, by comparison with the table and figures given above, it is shown that the straight maintenance of trunk line highways is more than covered by the receipts from automobile fees. Automobile fees have covered not only the cost of straight maintenance, but the cost of overhead, the charge for the purchase of equipment and the cost of oiling state aid roads. If the same rate of increase in number of motor vehicles continues for the next two or three years the straight maintenance of roads will not be a direct charge upon funds of the Highway Department secured from state appropriations.

Nevertheless, there should be large appropriations made for the replacements of roads in order, not only that this annual charge for maintenance may be reduced, but in order that the roads may give the best service at all times during the year, for as traffic increases there will be material necessity and demand for improving types of road surface which can only be met by extensive replacements.

Arterial Highway Construction in Pennsylvania

Main arterial highways in Pennsylvania are receiving the attention of the State Highway Commission and local road officials, according to advices received from the department. The reconstruction of a portion of state highway route 199, leading from Millersburg to Stine's Hill, a distance of about 5 mi., has been proposed by citizens of Millersburg. The department advises that the construction of arterial highways, of which the above is one, must come first, any amounts made available by the legislature being divided among the counties on a basis of mileage.

A tentative plan for proposed road construction in Luzerne County was also recently presented to the State Highway Department in view of appropriations being made by the legislature.

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[*] From the biennial report of State Highway Commissioner Charles J. Bennett, for the two years ending Sept. 30, 1916.

Redesign of Wood Block Pavement on the Queensboro Bridge, New York City

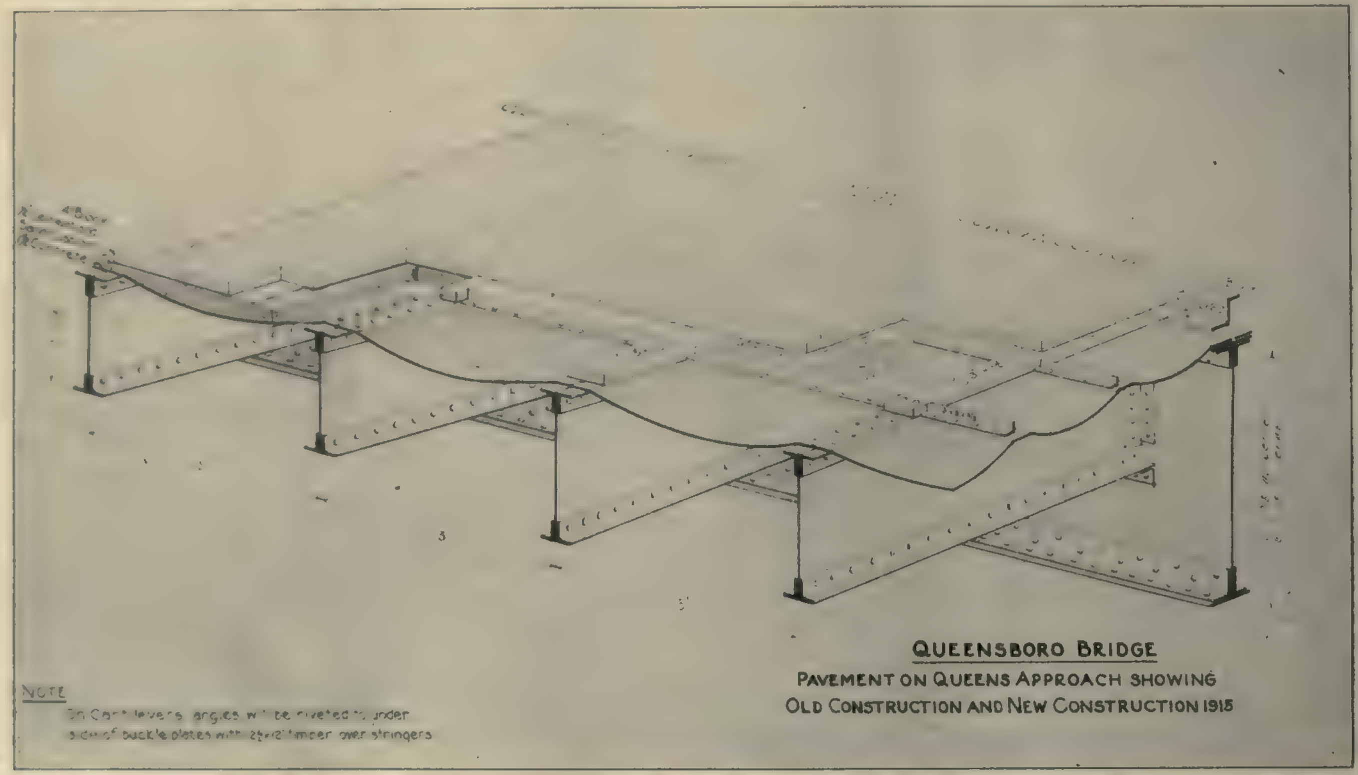
Increasing vehicular traffic over the highway bridges in New York City has necessitated the redesigning of the pavements on many of the more important structures. This work was described in a paper entitled "Roadway Pavement Problems on Bridges," presented at a meeting of the Municipal Engineers of the City of New York on the evening of Wednesday, April 25, by Edward A. Byrne, Acting Chief Engineer of the Department of Plant and Structures. The paper was printed in the April number of "The Municipal Engineers Journal," to which, with Mr. Byrne, we are indebted for the matter which follows and the illustrations accompanying it.

The Queensboro Bridge, connecting the Boroughs of Manhattan and Queens, is one of the four great bridges over the East River, and has a total length of some 7,450 ft. The roadway is 52 ft. 3 in. in width, which gives a pavement area of 43,240 sq. yd. In 1912, according to a table given in Mr. Byrne's paper, a 24-hr. traffic count of vehicles showed a total of 3,644, of which 1,354 were horse-drawn and 2,290 were motor-driven. A similar count in 1914 showed a total of 7,207 vehicles, of which 2,002 were horse-drawn and 5,205 were motor-driven. In 1916 a similar count showed an increase to 9,858 vehicles of all kinds, of which 1,554 were horse-drawn and 8,304 were motor-driven.

The old pavement on the bridge consisted generally of treated wood blocks laid on a Portland cement concrete foundation. On different parts of the structure this foundation rested on different bases. The principal difficulties were encountered on that portion of the bridge and approach on which the foundation rested on ⅜-in. buckle plates. The pavement laid over this portion of the bridge, according to Mr. Bryne, has been a constant source of trouble, and in 1916 the work of repaving this part of the bridge in accordance with a new design was commenced. The old construction and the new were described by Mr. Byrne in part as follows:

"The design of the roadway floor where buckle plates are used called for the placing of these plates on stringers having a top flange width of 12 in., spaced 5 ft. on centers, the plates being laid with the buckle down. On this floor a Portland cement concrete base (1:3:6) was laid. The depth of this foundation, for the greater part of the roadway, varied from 1½ to 4½ in. On this concrete a cushion of very dry cement and sand mortar ½ in. in depth was spread and the blocks were laid at right angles to the center line of the bridge, with ⅛-in. joints.

"The blocks were 4 in. in depth and cut from sound, long-leaf yellow pine planks, 4 in. thick and from 7 to 9 in. wide.


QUEENSBORO BRIDGE
PAVEMENT ON QUEENS APPROACH SHOWING
OLD CONSTRUCTION AND NEW CONSTRUCTION 1915
NOTE
On Cantilevers angles will be riveted to under
side of buckle plates with 2½×2½ timber over stringers

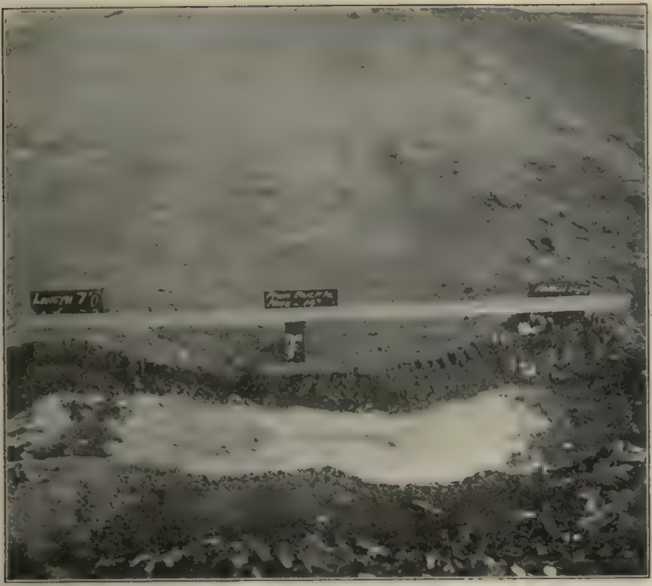
DRAWING SHOWING OLD AND NEW DESIGNS FOR THE ROADWAY PAVEMENT ON THE QUEENSBORO BRIDGE, NEW YORK CITY.

"The blocks were treated by the creo-resinate process, and the usual tests were specified.

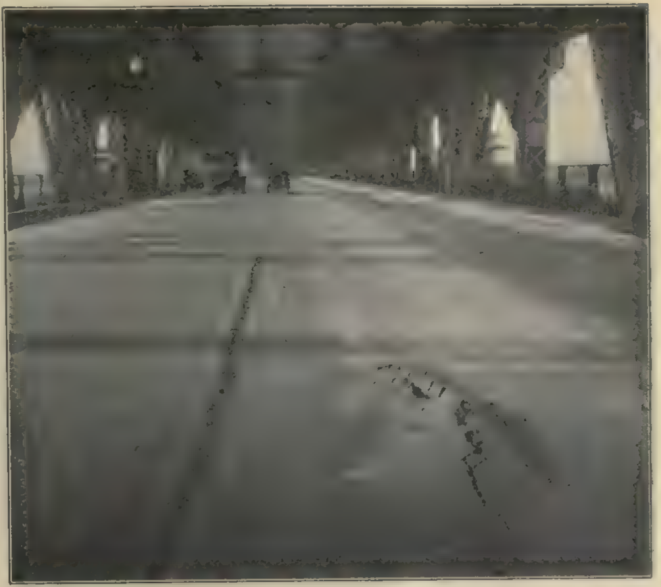
"The joints were filled with paving cement of a bituminous material free from coal tar or its products.

"This bridge was opened to traffic in March, 1909, and for the first two years of service this pavement required but slight attention, but the constantly increasing traffic commenced to affect the foundation quite seriously. The buckle plates, under the heavy traffic continually deflecting, caused the concrete to crack and disintegrate at many points. As the stringers provided a more rigid base, the concrete over them stood up much better.

"The concrete used was of very lean proportions for use under such conditions, and it might be justly stated as a further cause why this pavement failed. The sand and cement cushion has also been a source of trouble. This cushion, for lack of ability to drain, is always damp, and after storms it is thoroughly saturated. When these storms are followed by rapid changes in temperature, the blocks



OLD QUEENSBORO BRIDGE PAVEMENT—SHOWING WEAR OF OLD BLOCKS



A 14-IN. BULGE IN OLD PAVEMENT—NEW PAVEMENT AT LEFT—QUEENSBORO BRIDGE

commence to heave, and this heaving in many places has amounted to over 3 ft. above the normal surface of the pavement. This cushion provides a shifting base for the blocks, and this, together with the expansion and contraction of the bridge, further accelerates the movement of the pavement. * * * * * On one or two occasions vehicular traffic over the bridge had to be confined to the spaces occupied by the trolley tracks to avoid possible accident. There are two trolley tracks laid on this bridge within the pavement limits, each located near the curbs.

"A new foundation has been designed by the author, which in general consists essentially of a parquet foundation, formed by a combination of timber planking and Portland cement concrete, with the creosoted wood blocks laid directly on this foundation, without a cushion.

"The timber used was long-leaf yellow pine, merchantable inspection, dressed to a thickness varying from 2½ to 4½ in. on the main spans with a width of 14 in., and on approach span from 3 to 3½ in. with a width of 12 in. These planks were laid flat and bolted to each line of stringers by machine bolts spaced 27 in. apart. The planks were given two coats of preservative mixture, applied by brush method. The heads of the bolts were finished flush with the top of the plank and the countersunk hole around the head was filled with Portland cement mortar. The space between the planks was filled with a Portland cement concrete (1:2:4), the top of which was finished smooth at the top of the plank.

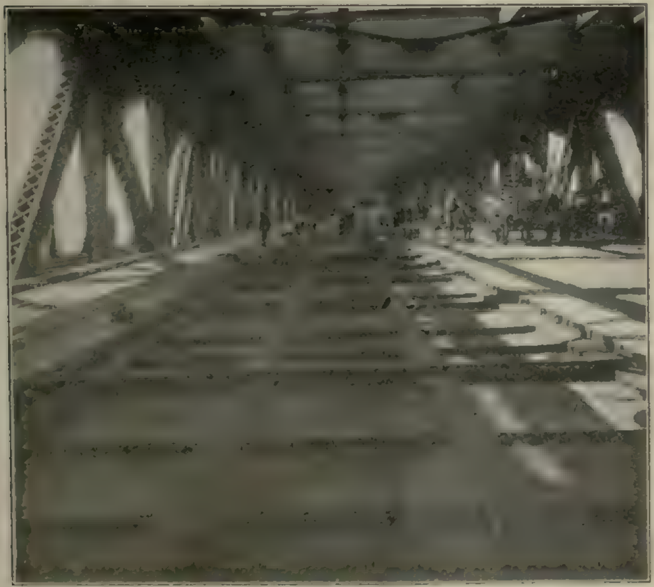
"On this composite foundation creosoted wood blocks were laid, with a sand joint, and, as stated before, without a cushion. These blocks are 3 in. in depth and cut from 3x8-in. long-leaf yellow pine timber.

"The buckle plates have been reinforced by riveting 3x3x⅜-in. angles to the unsupported fillet of the plate. On the main bridge these angles are riveted to the underside of the plate, and on the approach span, on account of structural details, they are placed on the upper side of the plate.

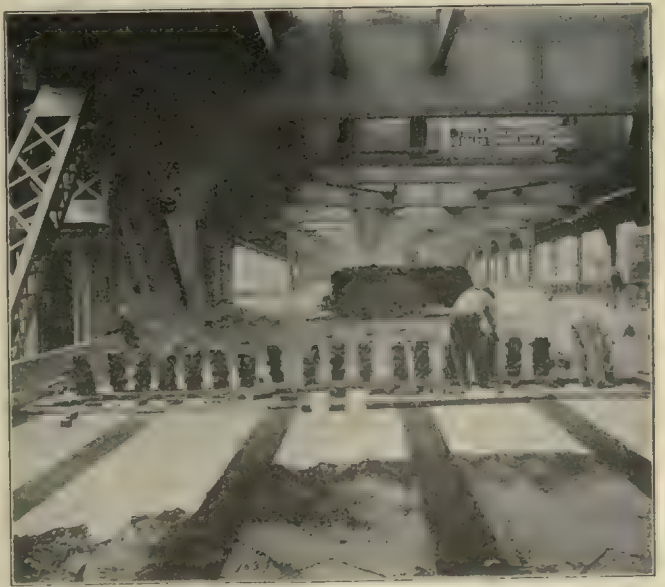
"The holes in the inverts of the plates are utilized for draining any water that may reach the under side of the wood blocks. This drainage has been provided by forming a hole in the concrete foundation over the holes in the invert of the buckle plate.

"To assist the drainage, grooves ¼ in. deep and 1¼ in. wide have been molded in the top of the concrete, which help to lead the water to the drain holes.

"The longitudinal movement of the pavement has been



FOUNDATION FOR NEW WOOD BLOCK PAVEMENT—QUEENSBORO BRIDGE



LAYING WOOD BLOCK PAVEMENT ON THE FOUNDATION WITHOUT A CUSHION COURSE checked by the installation of transverse Z-bars at alternate floor beams, forming longitudinal panels varying from 41 to 80 ft. in length. The tops of these bars are flush with the top of the pavement."

The old and the new designs are shown in one of the accompanying illustrations. The old design has a weight per linear foot of bridge of 3,750.2 lb. on the river spans and 4,725.7 lb. on the land spans. The weights of the new design per linear foot of bridge are 2,966.9 lb. on the river spans and 3,942.9 lb. on the land spans.

Lessening the Danger of California Grade Crossings

With a view of reducing the number of accidents at grade crossings in the state, the California Railroad Commission started an investigation about a year ago and since then has made examinations of some 2,000 crossings and has made recommendations for improving the conditions at about 1,600 of them. The Railroad Commission has exclusive jurisdiction over all railroad grade crossings in existence in the state and over all those that may be built in the future. Its work is summed up in a recent bulletin in which there are also included various suggested plans for making such crossings safer. A review of this work was also given in a paper entitled "Accidents at Grade Crossings and to Tresspassers," presented at the 1916 convention of the County Supervisors of California by Alex Gordon of the California State Railroad Commission. An extract from this was printed in "Good Roads" for September, 1916.

The preliminary work of investigation was commenced in January of last year by the publication of a pamphlet in which the crossing problem in California was outlined, the steps the commision could take to safeguard crossings were reviewed and the aid of all in any way able to co-operate in the work was asked. This was sent to all the supervisors in the state, to the officials of all cities, towns and railroads, to automobile clubs, and to others who might be interested. Following this, in March, hearings were held at Sacramento, San Diego, Fresno, Los Angeles and San Francisco, and shortly after that field work was commenced. It is still being done and will probably be completed in about a year.

The field work consists of careful examinations by the commission's engineers, from which reports are made to the commission. Wherever possible the inspection by the commission's engineers are made in cooperation with representatives of the railroads and the public bodies concerned. As a rule, it has been possible to secure this cooperation, although in some cases it has been necessary to make two inspections of a crossing in order to accommodate all those concerned. By the beginning of this year surveys had been completed in Ventura County, in the unincorporated territory in Los Angeles County, in the incorporated towns and cities on the Salt Lake Railroad, in some of the incorporated towns and cities on the Santa Fe and Pacific electric lines, on parts of the Northwestern Pacific and on the Southern Pacific lines in Stanislaus County. In addition surveys had been nearly completed in Marin and Sonoma Counties; surveys had been made in the unincorporated territory and in some of the incorporated territory on the Southern Pacific and Western Pacific in Alameda County, on the main line of the Southern Pacific in Madera County and along all lines of the Southern Pacific in Merced County. There had also been made a large number of examinations of Southern Pacific and Sante Fe crossings in San Joaquin County and of about 25 crossings in different parts of the state in response to informal complaints. The reports made were varied from those merely stating existing conditions and requiring no recommendations to those requiring detailed study with extensive recommendations. The object of the commission in making recommendations has been to avoid ordering grade separations that neither the railroads nor the political bodies could afford and to make the cost of the work recommended as light as possible by balancing the hazard at each crossing with the cost of removing it; that is, removing it as nearly as possible without either abolishing the crossing or separating the grades. The 1,100 recommendations made by the commission were classified by it in accordance with the following table taken from the bulletin:

Install human flagmen	4
Install automatic flagmen or bells	66
Install gates	4
Place, remove or change position of signs	449
Cut brush or trees or trim trees	319
Remove buildings, billboards and other obstructions	30
Grade approaches	27
Change alignment of road	4
Grade between rails	14
Change grade of track	1
Close crossings	92
Separate grades	18
Change location of crossing	1
Change to private crossing	7
Operate trains over at slow speed	2
Other minor recommendations	62
Total	1,100

The work of the commission has resulted in bringing to its attention many suggested protective devices, several of which are illustrated in the bulletin. Among these, according to the commission, the automatic flagman appears to be the most efficient and 66 of them have been recommended to replace the ordinary crossing signs and bells. One of the methods that has been given special consideration by the commission is that of placing obstructions in the roadway to compel slow speed. One of those submitted to the commission by the Southern Pacific Co. involves the placing of automatic danger signals in the center of the roadway 50 ft. from the center of the tracks on each side of the crosing. Another submitted by J. H. Weatherford, City Engineer of Memphis, Tenn., provides for a hump in the roadway 50 ft. to either side of the crossing. What is designated by the commission as the best type of crossing so far designed is a combination of these two devices that was suggested by City Engineer O'Shaughnessy of San Francisco. This plan provides for slightly breaking the profile of the road about 400 ft. from the crossing on each side, placing a warning sign on the right hand side of the road 25 ft. from this break toward the crossing and at about 50 ft. from the crossing, placing an automatic flagman device in the center of the road and immediately beyond it placing an accentuated break in the profile.

In concluding the bulletin the commission expresses itself as much gratified by the cooperation it has received from the railroads and from the representatives of cities, town and counties. Railroad companies, according to the bulletin, have questioned only a few of the recommendations made to them and, except in the matter of closing streets, public authorities have shown a similar willingness to assist.

Development of the Kingshighway, St. Louis, Missouri

The development of the Kingshighway in St. Louis, Mo., into an extensive boulevard system has been in progress for a number of years. The mill tax upon railway receipts has yielded a surplus sufficient to complete the system, it is claimed. The estimated costs of constructing the remaining section of the highway are as follows:

Christy Park, from Nottingham Ave. to Kansas St., $81,000; Penrose Park, Bellerive Park bridge, over Broadway, $55,000; Drive along Bellerive Park and building wall and balustrade, $10,000; Penrose Park to Florissant Ave., city's share, $85,000; Viaduct over Terminal tracks, Penrose Park, city's share, $25,000; Viaduct over Terminal track at Euclid Ave., city's share, $35,000.

A State Highway Department Established in Nevada by New Highway Law

The general highway law which was enacted by the State of Nevada at the 1917 session of the legislature provides for the creation of a department of highways to consist of three directors and the state highway engineer. The directors are appointed by the governor for terms of 3 years, except in the case of the first appointees whose terms of office are one, two and three years, respectively. The salary of each director, as provided in section 2 of the act, shall be "$10 per day for each day necessarily employed in the business of the department, not to exceed $1,000 per annum," and they are entitled to their actual traveling expenses when attending to the affairs of the department. Not more than two directors of the same political affiliation may be appointed, and any of them may be removed by the governor "with or without cause."

The directors are required immediately upon their appointment to organize the department by meeting at Carson City and electing one of their number chairman of the board, and as soon as practicable, to appoint a state highway engineer. It is the duty of the directors to meet as often as it is necessary to comply with the provisions of the act, to consider all matters relating to the general policy of the department, and to recommendations, reports and other matters that it may be advisable to present to the governor or the legislature.

The state highway engineer must be one experienced in highway and bridge design, construction and maintenance. He receives salary of $4,000 per annum, and his "actual necessary traveling expenses when absent from the state capital upon business of the state." He is required to devote his entire time to the duties of his office, and upon 60 days' notice he may be removed by the board of highway directors, with or without cause.

The state highway engineer is authorized to employ engineers, clerks and such other assistants as may be necessary to properly carry on the work of the department, and to fix their compensation subject to the approval of the directors. The offices of the department of highways, which are provided by the board of capitol commissioners, are in charge of the state highway engineer, who also has charge of all the records of the department. The law requires him to have made and kept a general plan of the state, and to "collect information and compile statistics relative to the mileage, character and condition of the highways and bridges in the different counties of the state," and upon investigation of methods best adapted to certain sections to establish standards for road construction and maintenance in the various counties with regard to natural conditions and availability of materials. It further provides as follows:

> He may at all reasonable times be consulted by county officers having authority over highways and bridges relative to any question involving such highways and bridges, and he may, in like manner, call on such county officials for any information or assistance they may render in the performance of his duties with reference to the highways and bridges within their county, and it shall be the duty of such county officials to supply such information when called upon for same by the said state highway engineer. He shall determine the character and have the general supervision of the construction and repair of all roads and bridges improved under the provisions of this act. He shall report all the proceedings of his office to the board of highway directors annually, and at such other times as they may designate.

Section 7 of the act provides for the acceptance of federal aid in accordance with the act of Congress of July, 1916. Sections relating to the application of federal funds on the highways of the state follow:

> Section 8. The highways which are constructed or improved by the department of highways in accordance with routes set forth and described in this section shall be state highways and shall be constructed or improved and maintained by the department of highways; provided, that the funds available to the state through the act of Congress or other federal acts may be used therefor; and provided, further, that when such federal funds are made available, under section 8 of said act of Congress, or other federal act or acts authorizing the use of federal funds to build roads in the national forest, the board is authorized and empowered to set aside for the purpose and to expend said highway funds on state highways built by the federal government. Such state highway routes are hereby designated and are set forth and described as follows:
>
> Route 1. Beginning at a point east of Tecoma at the Utah state line, running thence in a westerly direction through the towns of Montello, Cobre, Wells, Deeth, Halleck, Elko, Carlin, Beowawe, Battle Mountain, Golconda, Winnemucca, Imlay, Lovelock, Fernley and Wadsworth to the city of Reno, thence westerly through the town of Verdi and to the California-Nevada state line.
>
> Route 2. Commencing at a point on the dividing line between White Pine County and the State of Utah, thence in a southwesterly direction to the city of Ely; thence westerly passing through the towns of Eureka, Austin, Fallon and Haven to a junction with route one as herein described at a point between the town of Hazen and the town of Fernley.
>
> Route 3. Commencing at the City of Reno, thence running southerly through the city of Carson City; thence westerly to Glenbrook on Lake Tahoe; thence in a southerly direction to the Nevada-California state line at or near Lakeside; beginning again at Carson City, thence to the town of Yerington by the most available and practicable route; thence to the northerly end of Walker Lake by the most available and practicable route; thence along the west side of Walker Lake to the town of Hawthorne; thence to and through the towns of Luning, Mina and Millers to the town of Tonopah; thence southerly to the town of Goldfield; thence westerly by the most practicable and available route to the Nevada-California state line.
>
> Route 4. Commencing at the city of Ely and running in a general southwesterly direction to town of Tonopah.

The construction of these routes is to commence as soon as funds are available.

The state highway fund is created by an appropriation of $40,000 from the state treasury, in addition to which there is levied for the year 1917 an ad valorem tax of 7ct., and for the year 1918 and each year thereafter, 10 ct. on each $100 of taxable property in the state, "including the proceeds of mines, which shall be collected as other taxes, and paid into the state treasury for said highway fund for the exclusive use and purpose of this act." Funds unexpended at the end of any fiscal year remain in the state highway fund for use during the succeeding year.

For the purpose of assisting the state in constructing the portion of a state highway or highways lying within any county, a "county-state highway fund" is created in the following manner:

> Section 10. The board of county commissioners of each and every county through which the state highway and state highway routes pass, * * * and all other officers having to do with the assessment of property and collection of taxes are hereby directed to levy and collect for the fiscal year 1917 a tax of 7 ct., and for the fiscal year 1918, and annually thereafter, a tax of 10 ct. on each $100 of taxable property within their respective counties. * * * The proceeds of said tax shall be set aside in a separate fund in the county treasury * * * and shall be expended only under the direction of said state highway engineer, and the moneys shall be paid out upon bills for construction upon the state highways within the county, certified by the state highway engineer, presented to and approved by the board of county commissioners as other bills against the county are paid.

The 7-ct. tax for the year 1917 is to all intents and purposes deemed to be levied in each county if the time at which the board of county commissioners levies taxes for other purposes had passed when the state highway law was approved.

In carrying out the cooperative plan between the state and the county, the department of highways must submit within 90 days after the act takes effect (March 23, 1917), and on Jan. 10 of each subsequent year, to the board of county commissioners of the counties in which state highways have been established, a detailed plan of the amount, character and nature of the construction work proposed to be done the ensuing year, and the board of county commissioners shall make available for the purpose all moneys in the "county-state highway fund," by an order duly entered. Neither the state highway fund nor the county-state highway fund may be expended on roads within the limits of cities or towns.

Bills for construction, improvement or maintenance chargeable against the state highway fund must be approved by the state highway engineer and then examined by the board of examiners, and if allowed the state comtroller after auditing the bill draws a warrant for the amount upon the state treasurer.

In the execution of work or improvements costing $2,000 or less it is discretionary with the state highway engineer, with the approval of the directors, whether such work shall be done by the department or by contract, but all proposed improvements costing more than $2,000 must be made by contract in accordance with plans and specifications prepared by the state highway engineer. The general plan of securing bids and awarding contracts followed in the various states, is adopted. All contracts must be executed in the name of the State of Nevada and must be signed by the chairman of the department of highways, attested by the state highway engineer under the seal of the department, the form and legality of the contract being approved by the attorney-general. The law provides that "any director of the department of highways or any state highway engineer or any officer or employee who shall become, directly or indirectly, interested in any contract for the construction, supervision, or maintenance of any of the state highways in this state shall be guilty of misdemeanor."

No contractor may sublet any contract without the written approval of the department of highways, and all obligations placed upon the original contractor are required of the subcontractor.

The repair and maintenance of all roads constructed as state highways must be paid out of the state highway fund, the work being performed by the state highway engineer. A written permit signed by this official is required for installing pipe lines, digging ditches, or for doing other work requiring parts of the road surface to be removed, except in a case of immediate necessity.

The state highway engineer is empowered to change the route of a state highway on account of grades, dangerous curves or inconvenient location, but the plan for the proposed change must first be approved by the directors.

Provision is made for the erection of permanent guideposts and signboards at crossing and at other places where warning signs are necessary, the work of installing such signs being a part of every plan and all specifications and contracts for highway construction.

Section 25 relating to advertising signs is as follows:

> No advertising signs, signboards, or boards or other materials containing advertising matter shall be placed upon or over any state highway, nor within 20 ft. of the main traveled portion thereof; nor upon any bridge or other structure thereon; provided, that counties, towns or cities of the State of Nevada may, by permission of the state highway department, place at such points as may be designated by the state highway engineer suitable signboards advertising such counties, towns or municipalities. If any such sign is placed in violation of this act it is thereby declared a public nuisance and may be forthwith removed by the department of highways or its employees. Any person placing any such sign in violation of the provisions of this section shall be guilty of a misdemeanor and shall be fined not less than $10 or more than $50.

A requirement of the law is that all roads built under the act shall be of such materials as will reasonably insure permanent wearing qualities and so as to provide against excessive maintenance cost, considering the traffic to be accommodated and the interests of the public. The work must provide for adequate drainage.

The section of the law relating to convict labor gives the department of highways authority to employ prisoners in the construction, improvement and maintenance of state roads, and on the preparation of materials for such purposes. The number of convicts required is sent at the time and to the place designated, by the warden of the prison, upon the proper requisition of the department which shall provide transportation, suitable camps and equipment for the convict force and guards. The work is done under the supervision of the state highway engineer, but the warden of the state prison retains control over the discipline of the prisoners. Outside of the cost of caring for and maintaining the prisoners at the state prison, it is intended that the department of highways shall bear any additional expense incurred by their use on road work. An allowance of time for loyalty and, in the discretion of the proper authorities, 25 ct. for each day's work faithfully performed, is authorized.

A railroad company whose tracks, either within a city or elsewhere, cross a state highway, is required to construct and maintain "asphaltum, gravel and asphaltum, or gravel and oil, or asphaltum base upon both sides of each track and for the full space between the tracks and for 2 ft. on the outer sides of each line of the tracks for the full height of the rails and the width of not less than 20 ft."

In the application of federal aid to counties the law provides that a county in which no state road or route is located is entitled to "the full amount which it has paid into the state treasury for the state highway fund less its proportional share for administrative and overhead expenses prorated on the basis of assessed valuation, and an additional amount which shall be equivalent to that proportion of the moneys received from the federal government * * * * which the assessed valuation of such county bears to the assessed valuation of the state as a whole which shall be used by such county in the building and maintaining of any highway within its borders," with the approval of the department of highways and in accordance with the law.

If additional funds are required for constructing a state road in any county, the board of county commissioners may authorize the expenditure of an amount in excess of the "county-state highway fund" on such highway. When requested by the board of county commissioners, it is the duty of the state highway engineer to take charge of the construction of any county road.

The state highway law authorizes the department to accept donations of money, labor or materials for highway improvement. The act repeals all previous acts in conflict therewith.

Delaware State Highway Commission Appointed

The personnel of the new state highway commission appointed by Governor Townsend of Delaware last week is as follows:

Gen. T. Coleman du Pont, of Wilmington; Josiah Marvel, of Christiana hundred, rural New Castle County; Walter O. Hoffecker, of Smyrna, Kent County; Joseph E. Holland, of Milford, Sussex County.

The $1,000,000 Road Bond Election for Wilbarger County, Texas., which was called for May 19, has been indefinitely postponed.

GOOD ROADS

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Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

MAY 5, 1917.

REDUCING THE GRADE CROSSING DANGER IN CALIFORNIA

At the beginning of this year 2,000 of the 10,000 grade crossings in the state of California had been examined by the Railroad Commission of that state as a part of its work in reducing the grade crossing hazard. The methods followed by the commission and the results accomplished have been set forth at some length in a bulletin which is reviewed briefly in other pages of this issue.

The importance of this work can hardly be overrated. According to figures made public by the commission, 229 people were killed and 896 injured in grade crossing accidents in California between June 30, 1914, and December 31, 1916. The reports and investigations of these accidents, according to the commission, bear out the belief that most of them were caused by carelessness, and this assumption is also warranted by the results of other investigations that have been made. For instance, in the issue of September 2, 1916, there was printed an extract from a paper by one of the California railroad commissioners in which were given the results of an investigation made by the Southern Pacific Co. Observations were made at 34 crossings and covered 17,000 motor vehicle drivers. Of these, it was stated 69½% looked neither way before crossing the tracks. This, of course, is an example of extreme recklessness and that so large a proportion of drivers should be guilty of it surely indicates that a much larger proportion fail to take reasonable precautions when driving across railroad tracks.

As pointed out by the commission, accidents of this sort will not be eliminated by installing warning signs and "only a certain percentage of them will be done away with by safety crossings, as the reckless driver may devote his energy to passing a barrier or protective device at top speed and thus pay less attention to approaching trains than he would without such protection." Obviously, the only way to eliminate grade crossings accidents is to abolish the crossings or separate the grades, but it is equally obvious that this cannot be accomplished for a long time because of the very high cost of the necessary reconstruction. At the same time the situation can be greatly improved in many instances by methods involving only a relatively small cost. The various means which can be used are noted in the table from the commission's bulletin which is reproduced on another page. The table also indicates, by the relative number of recommendations for each device suggested, the very large proportion of the crossings which can be made safer by such means.

Of the various means which have been suggested for safeguarding crossings the use of warning signs is undoubtedly the most common, but unfortunately is not necessarily effective. Those signs which merely indicate the presence of a crossing ahead are apt to command even less attention than the crossings themselves. Those which by means of bells, semaphores or other signals indicate not only the presence of a crossing but the approach of a train are an improvement over the signs of the other type, but, like them, are at best merely warnings. On the other hand, various devices which have been proposed to compel the slowing up of vehicles have many advantages. Among these the practice of building a low hump in the pavement on each side of the crossing should, if properly carried out, serve to at least keep the speed of motor vehicles down to a reasonable limit when crossing the tracks. These can be so built as to cause no discomfort to the occupants of a car traveling at a speed of, say 10 mi. an hour, while at the same time making driving over them at greater speeds sufficiently uncomfortable to insure slowing up.

The grade crossing hazard is a very pressing one in every state and as it is a danger that cannot be eliminated, at least in the near future, work such as is being done in California is of the utmost importance and merits consideration by municipal, county and state road authorities.

ADEQUATE DRAINAGE PROVISIONS

Perhaps no essential of road and street construction has been more often urged than has proper drainage. It is the subject of at least one paper at almost every road convention and the text of many an article on road building. Its importance is almost universally recognized and the methods of obtaining it are very generally understood.

Yet in practice it is frequently neglected, as is shown by the illustrations accompanying the first article in this number.

Such consequences as followed the failure to provide proper drainage in the instances noted are, of course, to be regretted. On the other hand, they are not entirely unfortunate if they bring about reforms in future work—as they evidently have done in this particular case.

Neglected drainage undoubtedly does the most damage, however, in those cases where its results are less obvious than in the cases illustrated. For example, there are miles and miles of country roads that are in poor condition, principally because of the inadequate drainage systems put in when they were built. A considerable portion of this enormous mileage could be greatly improved by the redesign and reconstruction of the drainage—and at a cost that would be small as compared with the resulting increased value of the roads.

Another excellent reason for looking after the drainage is that the drainage system is one of the "permanent" parts of a road—not permanent in the strict sense of the word, but properly so described because if built right and kept in good condition it will last indefinitely.

The Street Paving Commission of Anderson, S. C., recently awarded a contract for asphalt and brick street construction, approximating 150,000 sq. yds., at a cost of about $300,000. It is reported that the paving is to be started by May 1, and finished within 10 months.

The New Highway Law of North Dakota

At the 1917 session of the North Dakota Legislature several bills relating to road work were enacted into laws. Among these the three important ones were an act creating a state highway commission and providing for state aid and cooperation with the federal government, a bill providing for the dragging of roads and a bill providing for the registration and regulation of motor vehicles. The provisions of the first mentioned, designated as House Bill 168, are substantially as follows:

Section 1 provides for the creation of a state highway commission consisting of the governor who shall be chairman, the state engineer, the commissioner of agriculture and labor, and two members to be appointed by the governor.

Section 2 provides that within 30 days after the act takes effect the state highway commission shall meet and that thereafter it shall meet at such times and places as may be necessary. The commission is charged with the duty of determining the character and having general control and supervision of the construction, improvement, repair and maintenance of all roads and bridges improved under the act. It is provided that it shall reserve out of the state highway fund a sufficient amount annually to meet its expenses and to pay the state's portion of the cost of maintaining highways and bridges improved under the act and that the balance of the state highway funds shall be expended in the improvement of highways and bridges in the various counties, 10% to be expended at the discretion of the commission without regard to the amount collected in any one county and 90% to be expended in the counties in proportion to the amounts collected therein.

Section 3 provides that each appointed member shall receive $10 per day for the time actually spent in the performance of his duties, provided that no member shall receive more than $600 in any one year, and that the members shall be allowed traveling expenses.

Section 4 provides that the state engineer shall be the chief engineer and secretary of the state highway commission at a salary of $1,000 per year in addition to his salary as state engineer. This section lays upon the state engineer the duty of keeping all records of the commission and copies of all plans, specifications and estimates prepared by his office; of making a general highway map of the state and a map of the highways "which in the judgment of the several boards of county commissioners and the highway commission are of sufficient importance to be designated as state roads;" of collecting data on the roads and bridges of the state; of investigating and determining the best materials and methods for construction and maintenance in various parts of the state; of exercising general supervision, subject to the approval of the state highway commission, of the construction, improvement, repair and maintenance of roads and bridges built under the act, and of preparing all plans and specifications for such work. It is also provided that the state engineer shall consult with county officials having authority over roads and bridges and that county commissioners must furnish or require the proper county offcials to furnish, upon the request of the state engineer all information they are able to give relative to the highways and bridges in their counties.

Section 5 provides that whenever a board of county commissioners decides upon the improvement or construction of any road under the provisions of the act, it shall make written application to the state highway commission for aid in such work. After the state highway commission is satisfied as to the character of the proposed work and the importance of the road to be improved, it may do the work in accordance with plans and specifications prepared by the state engineer. If the improvement costs $3,000 or less the state engineer, subject to the approval of the commission, may do the work, allow the county to do it or may award a contract for it. Where the cost of the improvement exceeds $3,000 the state engineer must advertise for bids for the work. Bids must be accompanied by a certified check for an amount equal to 5% of the bid.

Section 6 provides that the state engineer shall award the contract for work advertised in accordance with the provisions of the previous section to the lowest responsible bidder, subject to the approval of the county commissioners. He may reject any or all bids and if no satisfactory bids are received new bids may be called for or the work may be done by the state highway commission.

Section 7 provides that the necessary bridges on any highway shall be considered parts of the highway but that contracts for bridges may be let separately. This section also provides that the cost of all work of constructing or improving bridges or highways under the provisions of the act shall be paid 50% by the state and 50% by the county in which the work is situated. All highways and bridges constructed or improved under the act must be maintained in accordance with standards prescribed by the state highway commission and subject to the inspection of the state highway engineer, and the cost of such maintenance must be paid 50% by the state and 50% by the counties. If a county neglects to maintain any road improved under the act the state engineer may do the work and charge the county's portion of the cost to the allotment due to the county from the state highway fund for the year in which the work is done

Section 8 assents to the provisions of the federal aid law passed in July of last year and authorizes the state highway commission to cooperate in all necessary ways with the federal government in the construction of roads under the provisions of the federal aid act.

Section 9 appropriates $8,000 for the immediate organization of the state highway commission and for the performance of necessary preliminary work and the purchasing of supplies and securing assistants. The sum appropriated by this act is not subject to the provisions of Section 2.

Section 10 provides that the secretary of state shall pay to the state treasury all money received as motor vehicle license fees and that on the 15th day of each calendar month the state treasurer shall pay to the county treasurer of each county one-third of the sum received by him and shall credit the remaining two-thirds to the state highway fund, first deducting the expenses of registration.

Section 11 provides that all claims for money expended by the state highway commission shall be paid by the state treasurer on warrants prepared by the secretary of the state highway commission.

Section 12 provides that the money from motor license fees received by each county from the state treasurer shall be expended only for the repair and dragging of highways within the county, under the direction of the county commissioners, provided that upon application of any township which levies 50 ct. or more on each $100 valuation, the county commissioners shall credit such township with $5 per mi. to be used in dragging the roads of that township, provided that there are sufficient funds available; "otherwise the money shall be prorated between the townships making application therefor." No township may receive more than $50 from this source in any one year and none of the money provided for by this section may be expended within the limits of an incorporated city or village.

The bill for the dragging of roads provides that all townships within the state shall levy a tax sufficient to create a road dragging fund of not over $15 for each mile of graded road within the township. The board of county commissioners or the board of township supervisors, as the case may be, must divide each township into road dragging districts and enter into contracts with residents of these districts to drag the roads when notice is given by the township or district overseer of highways. If contracts cannot be made with residents of the district, the county commissioners or the board of township supervisors may make contracts with persons within or without the township. In no case must the amount paid for dragging exceed "the sum of $1 per mi. for each mile traveled back and forth while dragging the roads." The law also provides forms for reports on the dragging work done and for dragging records of the township.

The law for the registration and regulation of motor vehicles levies a minimum registration fee of $6 for each motor vehicle with an additional fee of 50 ct. for each additional horsepower above 20. There is a proviso, however, that if a motor vehicle has been licensed for three separate years the fee shall be one-half the amount prescribed. The law also provides for the regulation of speed, the use of headlights, and other matters.

New Road Laws of Idaho

The 1917 session laws of the State of Idaho contain a number of special acts and amendments to existing laws relating to highway administration and construction in that state. The most important of these are the acts authorizing the acceptance of federal aid under the jurisdiction of the state highway commission and providing for the issuance and sale of bonds in the sum of $1,000,000 for paying a portion of the cost of laying out, surveying and constructing a system of state highways, and the amendment to the laws relating to the licensing and regulation of motor vehicles.

The bond issue, with federal and forest funds, will provide about $2,500,000 for road work in Idaho. The bonds bear interest at a rate not to exceed 4½% per annum, and will mature in 20 years, but may be redeemed after 10 years.

The proceeds of the sale of the bonds constitute the state highway fund, together with such other funds as accrue thereto, including government aid, which fund is appropriated for use on the state highways, all bridges, culverts and grades and the purchase of rights of way. A "state highway redemption fund" for paying the principal of the bonds and interest thereon is created by a tax levy of one-tenth of one mill upon each dollar in value of the taxable property within the state.

The law directs the use by the state highway commission of the funds so derived upon state highways as follows: (a) Completion of road from Idaho-Utah line in Bear Lake County through the Counties of Bear Lake, Bannock, Power, Cassia, Twin Falls, Gooding, Elmore, Ada, Canyon and Washington to the Idaho-Oregon line, not less than $160,000; (b) completion of road extending from the Idaho-Utah line in Franklin County through the Counties of Franklin, Bannock, Bingham, Bonneville, Jefferson, Madison and Fremont to the Idaho-Montana line near the boundary of Yellowstone Park, not less than $85,000; (c) construction of road extending from the Town of Mackay through the Counties of Custer and Lemhi to a point on the Idaho-Montana line in the vicinity of Gibbonsville, not less than $120,000; (d) construction of road extending from Weiser, through the Counties of Washington, Adams, Idaho, Lewis, Nez Perce and Latah, known as the north and south highways, not less than $375,000; (e) completion of a section of road extending through the Counties of Kootenai and Shoshone from the Idaho-Washington line to the Idaho-Montana line, not less than $75,000; and (f) to the completion of construction of other state highways or bridges in cooperation with counties or the federal government, and for the reimbursement of certain counties which have advanced money for the entire cost of constructing parts of state highways during 1916. The apportionment is contingent upon the availability of coöperative funds to be received from counties, highway districts and the government, as provided by law, or from other sources.

The amendatory act regulating the use of motor vehicles prescribes a progressive license fee of $15 a year for a vehicle weighing 2,000 lb. or less to a fee of $40 for a vehicle weighing more than 4,000 lb., but provides that for a car wihch has been owned or used for 5 years the license fee will be two-thirds of the regular tax on a new vehicle. The annual license fee for a motorcycle is $5. Demonstration cars or those used for the purposes of testing are exempt from individual registration under a proviso requiring a manufacturer or dealer to register for each make of vehicle with the secretary of the state highway commission. A manufacturer's or dealer's license fee is $35 for one make of vehicle, and $25 for each additional make handled. A dealer's license fee for motorcycles is $15 a year. The law requires dealers and manufacturers to render statements of cars sold, these to be rendered to the assessor of the county in which the purchaser resides.

The cost of maintaining, supervising and paying convicts engaged in road work is met by an appropriation of $15,000 from the state treasury.

Two acts amending certain features of the highway district laws were passed. One of these relates to the power of a highway board to tax residents of incorporated municipalities that are included in a highway district, and the other provides for the creation and organization of a highway district from a part of any highway district already established.

Another amendment to the political code of the state places the treasurer of a good roads district in charge of all funds belonging to the district, and authorizes him to pay out the same upon approval of the district commissioners.

Measures providing a definite appropriation for the salaries and expenses of the state engineer's office, and for a "city manager plan" of government for cities having a population of 2,500 inhabitants or over, were also passed.

Appointment of New Highway Commission of North Dakota, and Plans for 1917

In accordance with the amended highway law of North Dakota, Edmund White of Mohall and Theodore Andrew of Mayville have been appointed members of the new State Highway Commission of the state. The other members are Governor Lynn J. Frazier, Chairman; Commissioner of Agriculture and Labor John A. Hagan and State Engineer Jay W. Bliss, Secretary, all ex-officiis. P. W. Thomas has been appointed Assistant State Engineer and will have charge of bridge work.

The first meeting of the commission was held on April 20 and 21. At this meeting a system of state roads was adopted and State Engineer Bliss was instructed to make preliminary surveys and prepare plans and estimates for road work in Grand Forks and Cass Counties.

Toward the end of April applications for state and federal aid had been received from about 15 counties in the state and the work of making surveys in a number of these will be commenced during the current month.

It is expected that about 200 mi. of first class earth and gravel road will be built under the direction of the State Highway Commission this year.

An Honor System in the Use of Convicts on Missouri Roads is to be followed in building the 3,500 mi. of highways which the state proposes to construct. The cost of maintaining the prisoners, estimated at 50 cts. per day per man, is the county's share of the expense.

MEETINGS

Calendar of Coming Meetings

May 7-9.—National Conference on City Planning—Annual Conference, Kansas City, Mo. Secretary, Flavel Shurtleff, 19 Congress St., Boston, Mass.

May 8-9.—Institute of Paving Brick Manufacturers—Convention St. Louis, Mo. Secretary, H. H. MacDonald, 830 B. of L. E. Building, Cleveland, O.

May 23-24.—Michigan State Good Roads Association—Annual meeting, Saginaw, Mich. Secretary, A. A. Anderson, Hastings, Mich.

June 11.—New York State Conference of Mayors and Other City Officials—Annual Conference, Buffalo, N. Y. Secretary, W. P. Capes, 25 Washington Ave., Albany, N. Y.

June 26-30.—American Society for Testing Materials—Annual meeting, Atlantic City, N. J. Secretary, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

American Society for Testing Materials

The twentieth annual meeting of the American Society for Testing Materials will be held at Atlantic City, N. J., on June 26 to 29, inclusive. The headquarters of the Society will be at the Hotel Traymore.

According to the provisional program, which is subject to change and further announcement, there will be business meetings on Tuesday, June 26, at 11:00 a. m. and 3:00 p. m., at which a number of committee reports will be heard. The reports and papers on tests and testing, in which are included "Distribution of Pressure Through Earth Fills," by A. T. Goldbeck, Engineer of Tests, United States Office of Public Roads and Rural Engineering, and "A Method for Studying the Effects of Temperature upon the Physical Condition of Asphalts, Waxes, Etc.," by J. A. Capp and F. A. Hull, are scheduled for the afternoon. The announcement of the election of officers will be made in the morning. At 8:00 p. m. the annual address of the president will be delivered and a reception tendered to members and guests, including ladies. The afternoon of June 27 is reserved for recreation.

Among the reports and papers to be heard at the Thursday morning session are the report of Committee D-4, on Road Materials, L. W. Page Director, U. S. Office of Public Roads and Rural Engineering, Chairman, and "A New Consistency Tester for Viscous Liquid Bituminous Materials," by P. Hubbard, Chief, Division of Road Materials, Tests and Research, United States Office of Public Roads and Rural Engineering, and F. P. Pritchard. A golf tournament is to be arranged for the afternoon. The Thursday evening session will be devoted to the subjects of cement and concrete. Among other papers to be presented at this session are "The Effect of Rate of Application of Load on the Compressive Strength of Concrete," by D. A. Abrams, Professor in Charge, Structural Materials Laboratory, Lewis Institute, and "Tests on Concrete Slabs of Varying Densities," by A. N. Johnson, Highway Engineer, Portland Cement Association.

A number of reports and papers on concrete and lime are scheduled for Friday morning, June 29. These relate to reinforced concrete, concrete road aggregates and other phases of the question, and include papers on "Effects of Grading of Sands and Consistency of Mix Upon the Strength of Plain and Reinforced Concrete," by L. N. Edwards, and "Standardizing Proper Consistency of Concrete from Engineers' and Contractors' Viewpoints," by Norman G. Hough, Manager, Hydrated Lime Bureau, National Lime Manufacturers' Association.

The afternoon session will be devoted to ceramics and the evening to reports of committees on miscellaneous materials.

PERSONAL NOTES

F. J. Keis has resigned as City Engineer of Watervliet, N. Y.

W. E. Baldry of Dodge City, Kan., has succeeded A. R Young as City Engineer of Topeka, Kan.

R. R. Yates, Consulting Engineer of Kansas City, Mo., has been placed in charge of bridge construction in Dayton, Ohio, succeeding Paul D. Fuqua, resigned.

C. Maynard Farrow has been appointed County Engineer of Montgomery County, Alabama. Mr. Farrow was formerly County Engineer of Limestone County, Alabama.

Thomas J. Wasser has been made Engineer for the County Boulevard Commission, Jersey City, N. J., taking the place of Robert Gaw. Mr. Wasser was County Engineer of Hudson County.

W. G. Thompson has been appointed Assistant Highway Engineer of the New Jersey State Highway Commission at a salary of $4,000 a year. Mr. Thompson is a resident of Steelton, N. J., and has been engaged in road work in Connecticut and in the Canal Zone.

Thomas F. Cunningham, a well-known contractor of Philadelphia, Pa., died recently at his home on Merion Road, Merion, at the age of 57 years. He was the head of several contracting firms that have done a large amount of paving on Philadelphia streets. He is survived by a widow and five children.

M. W. Watson, Assistant Road Engineer of the Illinois State Highway Department for the past two years, has been appointed to the position of Road Engineer with the Kansas State Highway Commission, with headquarters at Topeka. Mr. Watson has been identified with a number of engineering projects in Illinois, Ohio and Kentucky. He is a member of the Illinois Society of Engineers.

NEWS NOTES

A Bill Recently Introduced in the Arkansas Legislature requires the driver of an automobile to stop and permit a pedestrian, who has not heeded the usual warning, to pass out of danger. A child under 12 years old must be removed to a place of safety before the car proceeds. A fine of $5 to $25 is fixed for failure to comply with this regulation.

The Relocation of Pennsylvania State Highway Route No. 241 has been proposed by a committee representing the Geigertown Good Roads Association, which has asked the State Highway Department for a preliminary survey of the proposed route on the west side of Hay Creek. The change would eliminate four bridges and two railroad crossings. The survey is to be made.

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Gravel Roads in Michigan

By D. A. THOMAS*

Michigan can probably lay claim to more miles of gravel roads than any other state in the Union. Over 3,000 mi. of this type, constituting 60% of the improved road mileage of the state, were completed according to the specifications of the Michigan State Highway Department at the beginning of the present year. This large mileage has been built because gravel roads have found favor with the majority of the people. The popularity of these roads would not justify their construction, however, were they not rendering economical and effective service throughout the state, and it is probable that they would not be popular were they not satisfactory. Perhaps 85% of the mileage is serving efficiently, often with a traffic, largely automobile, up to, or in excess of, 500 vehicles per day; and the former figure could be bettered had the roads received proper maintenance in the past.

The popularity of gravel roads can be attributed to a number of reasons:

1. Gravel roads constructed in accordance with the state's specifications draw a relatively high state reward—frequently one-half of the cost.

2. Suitable gravel is usually available locally, the expense is chiefly for labor, and all money spent in construction is kept at home. In this connection it should be said that farm labor and teams are usually employed at times when they are not actually needed in the fields, to the mutual advantage of the farmers and the road builders.

3. Gravel roads are easily built and repaired, requiring no expensive machinery.

4. The first cost is low. This is an important consideration in many low-valuation counties which would be financially unable to build high class roads and, as a matter of fact, the traffic needs of these counties do not demand the more expensive types, so the gravel road is ideal for them.

5. They can be maintained satisfactorily at a low cost in localities where the volume of traffic is not beyond the capacity of the road.

An incident might be cited to illustrate the usefulness of gravel roads as well as the attitude of the people toward them. Five years ago Genesee County bonded for $500,000 to build roads, the issue carrying by but a small majority. The money was expended on gravel roads and an extensive mileage built on a road system designed to serve the county

A 16-FT. GRAVEL ROADWAY ON THE LANSING-DETROIT ROAD.

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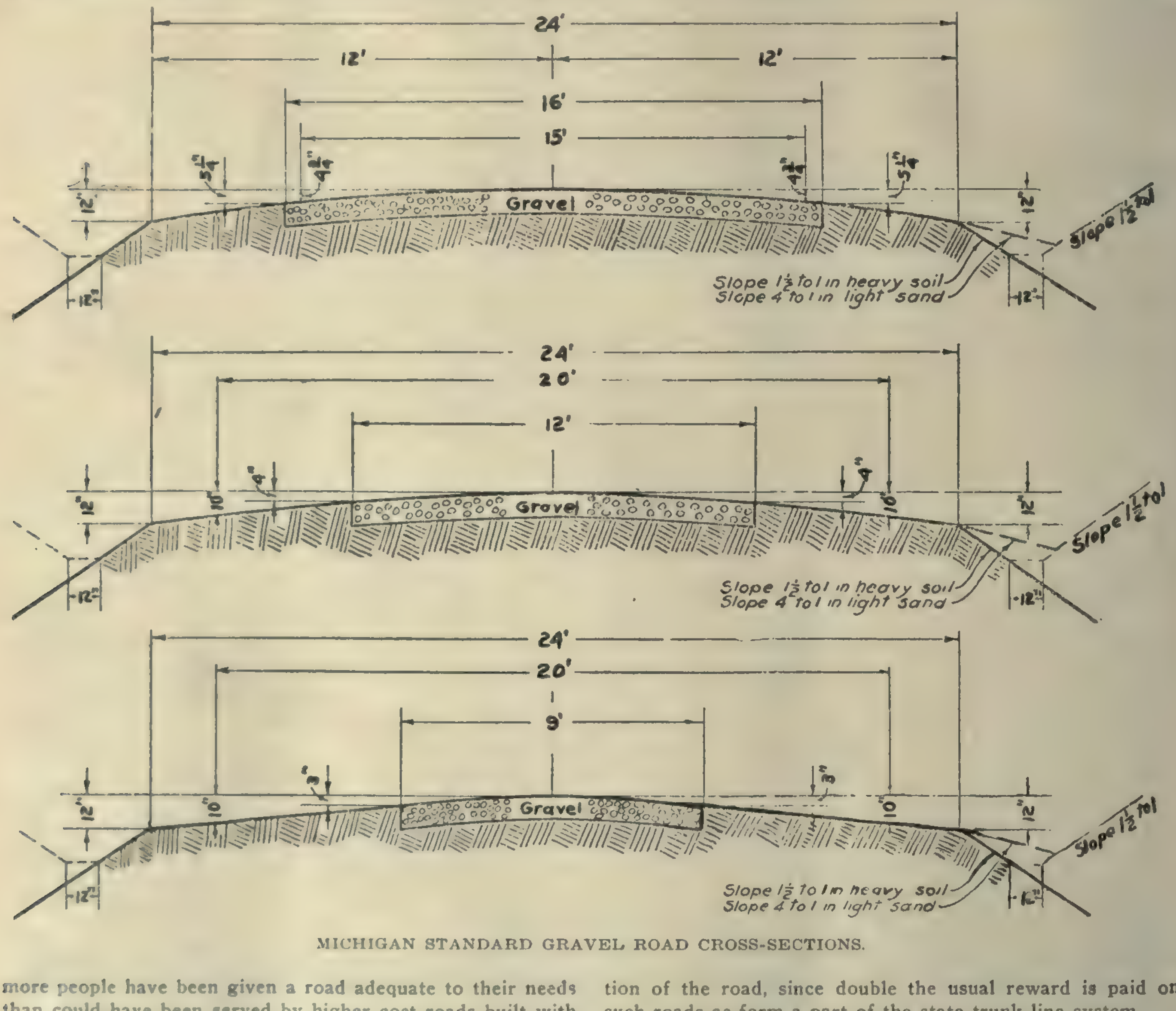
*Michigan State Highway Department.

as a whole. Last fall the county voted to bond again, this time for $1,000,000, and the issued carried by a majority of three to one. It is proposed to build with this some 70 mi. of gravel roads in extension of the present system and to replace with cement concrete and asphaltic concrete some of the old mileage for which the present traffic is obviously too heavy.

The results of this scheme of improvement are obvious The people of the county have been made to appreciate the value of good roads and they have learned the usefulness and the limitations of gravel roads. Meanwhile those roads which it is now necessary to replace have given good service and have saved the county the interest on the difference in cost between gravel and a more expensive road less the difference in maintenance cost, which would be slight; and many more people have been given a road adequate to their needs than could have been served by higher cost roads built with the same money. In fact, the opinion has been voiced that if but a few miles of expensive roads had been built originally, the last issue would have been defeated, and the experience of other counties in the state seems to bear this out.


24'
12'
12'
16'
15'
Gravel
Slope 1½ to 1
Slope 1½ to 1 in heavy soil
Slope 4 to 1 in light sand
12"
24'
20'
12'
Gravel
Slope 1½ to 1
Slope 1½ to 1 in heavy soil
Slope 4 to 1 in light sand
12"
24'
20'
9'
Gravel
Slope 1½ to 1
Slope 1½ to 1 in heavy soil
Slope 4 to 1 in light sand
12"

MICHIGAN STANDARD GRAVEL ROAD CROSS-SECTIONS.

It should not be inferred that the Michigan State Highway Department is in favor of any one type of road. In a system so large as to serve a whole state nearly every type of road has its place, and the same is true of most counties. Strictly speaking, that type should be selected which may be expected to carry the traffic for the least annual cost per vehicle mile, taking into consideration the annual interest on the first cost, the annual maintenance necessary to satisfactorily maintain the road, and a sinking fund which will renew the surface when it wears out (or retire the bonds issued for construction). Because gravel roads can be made to fulfill this condition in countless locations, the department has devoted considerable time to the development of suitable specifications and believes that where the traffic is not in excess of 400 or, under favorable conditions, 500 vehicles per day the construction of gravel roads is in accordance with good engineering practice.

Under the highway laws of Michigan the roads are constructed by the counties and townships, and state aid is extended to them in the form of rewards paid on roads constructed according to the state's specifications. A gravel road may draw from $500 to $1,700 a mile, depending upon its width and location. The reward is affected by the location of the road, since double the usual reward is paid on such roads as form a part of the state trunk line system.

The bank gravels of Michigan are of glacial origin and vary widely in character, from those of the Upper Peninsula and northern part of the state, which contain a large proportion of limestone pebbles, to the gravels in the southern part of the state, which are largely derived from such igneous rocks as granite and trap, and quartzite. Experience has shown that Michigan gravels are valuable for road purposes, as follows:

1. Almost in direct proportion to the percentage of pebbles constituting the mass.
2. In direct proportion to the value as road material of the rock fragments constituting the pebbles.

GRAVEL ROAD ON A MAIN HIGHWAY NEAR KALAMAZOO, MICH.—BUILT EIGHT YEARS AGO AND RESURFACED ONCE SINCE—NOW IN FAIR CONDITION.

3. In direct proportion to the value as a cementing material of the finer particles of earth matter constituting the filler or binder.

There is a tendency to place too much stress upon the immediate packing qualities of the gravel, and the fact is lost sight of that the only thing which makes a gravel road better than an earth road is its pebble or stone content. The material most sought after as a binder in road gravel is clay. If this is present much in excess of 10%, however, the road will become muddy whenever there is a prolonged wet period. Ideal clay gravel should contain only enough clay to coat the pebbles, with no free lumps.

Conforming to these principles the requirement in the specifications is that at least 60%, by weight, of the pebbles shall be pebbles more than ⅛ in. in size, with no pebbles in the bottom course that will not pass through a 2½-in. screen, and none in the top course that will not pass through a 1½-in. screen. For trunk line roads at least 75% of the pebbles in the top course must be pebbles passing a 1½-in. screen. Not more than 10% of the mass shall be clay, uniformly mixed and having no free lumps. An amendment provided by the 1917 legislature puts a premium on good gravel. The law states that for each 5% increase in percentage of gravel, over 60% up to and including 85%, retained on a ⅛-in. screen (and passing through a 1½-in. screen) 15% reward shall be added to the specified reward for single reward roads.

ROAD NO. 1—ELKLAND TOWNSHIP, TUSCOLA COUNTY, MICH.—FIRST STATE REWARD ROAD BUILT IN MICHIGAN—GRAVEL, BUILT TEN YEARS AGO AND RESURFACED ONCE—NOW IN GOOD CONDITION.

The specifications of the Michigan State Highway Department for state reward gravel roads provide for the construction essentially as follows: Before building any state reward road the plan and profile of the same must be submitted to and approved by the State Highway Commissioner. No grades may exceed 6%. The road is graded to conform strictly to the plans and specifications, with due attention given to drainage. Shoulders are formed on both sides of the roadway to retain the gravel within the width and depth specified. The gravel bed is then rolled until it is firm, and is 8 in. below and parallel to the finished grade.

The gravel, the specifications for which have already been given, is spread in two courses, the bottom and top courses being, respectively, 6 in. and 4 in. deep, loose measure, which forms a total compacted depth of 8 in. In both courses all depressions and ruts that form during construction are filled, and each course is in turn thoroughly harrowed and rolled until it is everywhere hard and smooth and the finished surface conforms to the proposed grade and cross-section. The importance of complete harrowing is emphasized. The ordinary spiked-tooth harrow is a tool second to none for compacting the gravel. The rolling is done after the gravel has been thoroughly wetted by sprinkling or rains.

Turning to a consideration of the cost we find a wide variation due to the great range of conditions. The cost of the gravel for a gravel road is a relatively unimportant item, although bettered specifications and logical increase in cost in recent years have raised the cost of the road slightly in so far as the gravel itself is concerned. The principal expense in the construction of a gravel road, however, is for labor and teams. Thus the length of haul materially affects the cost of the road. The increased wages that must be paid to secure labor and teams have very appreciably raised the cost of gravel roads even within the last year. From an extensive study of costs made some two years ago, the average cost based on 59 jobs aggregating 68.42 mi. of 9-ft. gravel roads was about $2,500 per mi. With a ¼-mi. haul the cost was $2,340, and with a 5-mi. haul, $2,850. At the present time a 9-ft. road costs, on the average, between $2,500 and $3,000. For a 16-ft. road, under present conditions, the cost averages between $4,500 and $5,000 per mi.

No matter how painstaking the work of construction may be, the final set will come only under traffic, and to insure that the road will "come down" with a good surface it is necessary to keep it smooth during the formative period. To do this the most effective tools are the plank or log drags or various forms of the steel drag.

These drags should be systematically used after rains when the gravel is in a packing condition, and in the subsequent maintenance of the road. When once compacted and maintained in a manner that gives perfect surface drainage, a gravel road may be expected to carry from 200 to 400 or, as has been stated, under favorable conditions, 500 vehicles per day with a maintenance seldom greatly in excess of $100 per mi. per year. Figures computed from reports at hand on March 1, 1917, representing 658 mi. of gravel roads indicated that these roads had an average of $68 a mile expended upon them during 1916 for maintenance.

The experience in Michigan has shown that gravel is a satisfactory road material from many standpoints, for roads of moderate traffic. It is reasonable to believe that there are many locations throughout the county where a properly constructed gravel road will fulfill the requirements of a truly economic road.

Colorado Road Administration Under the New Law

The act relating to highways, Senate Bill No. 328, which was signed by the Governor of Colorado on April 20, creates a state highway department and provides for the administration of highway affairs thereunder, the establishment of a system of proposed state highways, and the creation of a state highway fund. The law repeals all acts in conflict therewith.

As provided in the law, the new state highway department consists of a state highway commission of five members, a state highway commissioner and the necessary assistants, one member of the commission being appointed from each of the following districts:

District No. 1. The Counties of Adams, Arapahoe, Boulder, Clear Creek, Denver, Gilpin, Jefferson, Larimer, Logan, Morgan, Phillips, Sedgwick, Washington, Weld and Yuma.

District No. 2. The Counties of Chaffee, Cheyenne, Douglas, Elbert, El Paso, Kit Carson, Lake, Lincoln, Park and Teller.

District No. 3. The Counties of Baca, Bent, Crowley, Custer, Fremont, Huerfano, Kiowa, Las Animas, Otero, Prowers and Pueblo.

District No. 4. The Counties of Alamosa, Archuleta, Conejos, Costilla, Delta, Dolores, Gunnison, Hinsdale, La Plata, Mineral, Montezuma, Montrose, Ouray, Rio Grande, Saguache, San Juan and San Miguel.

District No. 5. The Counties of Eagle, Garfield, Grand, Jackson, Mesa, Moffat, Pitkin, Rio Blanco, Routt and Summit.

Each member of the commission is required to reside in his respective district and his removal therefrom constitutes his resignation from the commission.

The first commission is appointed as follows:

The five members of the Advisory Board heretofore appointed under the provisions of Chapter 88 of the Session Laws of 1913, and now in office, are hereby appointed members of the state highway commission hereby created to serve for the remainder of the terms for which they were respectively appointed, and until their successors are appointed and qualified.

At least 30 days before the expiration of the term for which each member is appointed, and thereafter annually as the successive terms expire, the governor shall appoint one person as the successor of the member of the commission whose term shall expire, to serve as a member of the commission for a term of 5 years, or until his successor is appointed and qualified. * * * *

Members of the Commission shall be removed by the governor only for cause, and then after a proper hearing. Upon the inauguration of a governor he shall not ask, nor shall it be expected, that any member of the commission shall resign because of any change in the administration.

If a vacancy occurs in the membership of the commission for any cause, the person appointed to fill such a vacancy shall be appointed only for the unexpired portion of the term of the member whose place he fills, and he shall be a resident of the same district.

Members of the commission shall serve without pay, but shall be allowed their actual traveling and other necessary expenses incurred in the performance of their official duties.

The state highway commission within 30 days after its appointment is required to meet at the capitol building in Denver, and select one of its number to act as chairman and one as vice chairman, and to appoint a secretary. The unanimous vote of the commission is necessary for any action taken by it, and in case of disagreement, the matter is decided by the governor, but the commission may proceed within its powers by a resolution duly signed by all the members and approved by the state highway commissioner.

The powers and duties of the commission are defined as follows:

1. To hold regular meetings at the office of the State Highway Department in Denver, at such times as it may determine, such regular meeting dates to be duly announced by the commission.
2. To hold such special meetings for the transaction of any business not by law required to be transacted at a regular meeting, at such times and such places as the Commission may determine.

The state highway commissioner shall attend all meetings of the commission.

3. To formulate and adopt rules and regulations for the expenditure, by or under the direction of, the state highway commissioner, of public funds for the construction, improvement and maintenance of highways and other purposes authorized by law and for letting contracts for any work which the commission or the department is authorized by law to do.
4. To formulate and adopt regulations governing the qualifications for the employment of all persons in the state highway department and fix their salaries, if such qualifications or salaries are not otherwise provided by law, and to inquire into the official conduct of any person in the department.
5. To prepare and submit annually to the governor, on or before the 1st day of January, a budget for the state highway department.
6. To require from the highway commissioner complete information concerning the work of the department under his charge.
7. To authorize and require the highway commissioner to make such special investigations and compile such special data as the commission may deem to be of value for the work of the department.
8. To establish, open, relocate, alter, widen or change any portion of a state route or state highway.
9. To determine what portion or portions of any state route shall be accepted as a state highway.
10. To determine what portion or portions of state routes shall be improved at the expense of the state.
11. To make agreements on behalf of the State of Colorado with the United States Government, or any department of the same, in any matter affecting the public highways of the state.
12. To make agreements on behalf of the state with any county, city or town of the state for the improvement or maintenance of any part of a state route, or at the joint expense of the state and the county, city or town.
13. To formulate reasonable rules and regulations governing the use by the public of state highways such as may be necessary to provide for the public safety and against undue use of the state highways.
14. To send its members or other representatives to attend meetings within or outside the State of Colorado, as the commission deems will be of benefit to the work of the state highway department.
15. To prescribe standard guide boards and road signs or other devices for the guidance of traffic to be erected upon all state highways; and prohibit the use of all guide boards and road signs not conforming to such standard, on any state highway in the state.
16. To exercise such other powers and duties as may be necessary for giving full force and effect to the foregoing provisions.

The state highway commissioner, who is appointed by the governor for a term of four years at a salary of $3,600 a year, must be at least 35 years old, and he must have had "at least three years' practical experience in the construction and maintenance of public highways." He may be removed only for cause and after due hearing, all of the members of the commission concurring, or upon failure to agree, his removal may be decided by the governor and a majority of the commission. If vacated, the office is filled for the unexpired term.

The state highway commissioner is required to appoint a deputy within 30 days after his own appointment, and if for any cause both commissioner and deputy should be unable to act, the chairman of the commission, or in his absence the vice chairman, is authorized to act for them. The deputy must be one already in the employment of the department, and must have the approval of the commission.

Among the powers and duties of the state highway commissioner, who is chief executive officer of the state highway department, are the following:

Outline an organization for the department, defining the duties of persons who may fill such positions, but the qualifications for the various positions are to be such as are prescribed by the commission.

Fill all vacancies that occur in positions under him in the department.

Suspend for due cause any employee in the department, but reporting the same immediately to the commission, whose determination in the matter shall be final.

> Prepare all plans and specifications, and advertise and let all contracts for work for the state on state highways or state routes authorized or approved by the commission.
>
> Have supervision of all work on state highways and state routes authorized by the commission. Except that nothing in this act contained shall in any manner interfere with the supervision of the road work by discipline or custody, of the warden of the state penitentiary, of convicts employed in highway construction, maintenance and improvement, as is now provided by law.
>
> Have charge of the maintenance or upkeep of all state highways and state routes, when authorized by the commission.
>
> Approve all payments for work done by the state on, or in connection with, state highways or state routes, and no payment shall be made by the state treasurer for such work without the written approval of the commissioner or his deputy or substitute.
>
> Formulate rules and regulations for the guidance of county boards in regard to work on state highways in the counties; he shall have the same printed and issued to all county boards.
>
> Give county boards and other officials charged with public highway work such information and advice as he may have at hand and as may be requested.

He is also required to make an annual report to the commission, to attend meetings and conventions within and outside of the state, and do whatever is necessary to properly carry on the work of the department.

Article III of the act relates to the classification of highways as "state routes" and "state highways." Section 1, referring to the former, provides that a system of proposed state highways, to be known as "state routes," is established, consisting of highways declared by previous legislation to be state highways, but the commission may abandon any road as such, or change a part of it, or add roads to the system.

Section 2 establishes a system of "state highways" to be improved and maintained and which shall consist of such parts of the state routes as may be designated or accepted by the commission, and this section further provides that:

> No highway or part of the same that has not been designated under the provisions of this act as a state route shall become a state highway, nor shall any portion of a state route become a state highway until by a proper resolution it shall have been specifically designated and accepted by the commission as a state highway.
>
> Until so designated and accepted, all state routes shall be part of the county highways and be constructed, improved and maintained as such except as otherwise provided in this act.

When a road within the system of state routes is designated as a state highway, it must be maintained or improved by the state highway commissioner, and any part of the system so accepted by the commission must thereafter be maintained by the state and the county in which the road is located, but in no case may the county be required to pay more than one-half the cost of maintenance. Upon the refusal of a county to pay its proportion of the cost either of the construction or maintenance of any state routes, the amount may be paid by the state and deducted from the county's share of state funds.

The county board may proceed to have a section of a state route designated as a state highway by a resolution calling for an examination of the road by the state highway department, and if its report is favorable, the road may be accepted.

The state highway commissioner is charged with the immediate control of the construction and maintenance of all state highways under the regulations of the department.

County highways, within the meaning of the act, are the roads already accepted or that may be accepted as public highways, excepting state highways, including state routes that have not become state highways.

Article IV relates to the establishment of highways by the commission, and provides that when the state highway commissioner finds it desirable to establish, relocate, or alter a portion of a state highway or state route, or when required by the commission, he shall make a report in writing describing the road in question, and giving other necessary information with an estimate of damages, et cetera, and if the commission deems it desirable for the interest or convenience of the public, it may give its approval and authorize the commissioner to proceed to carry out the work.

Where streets in incorporated cities or towns of less than 2,500 population form convenient links in state highways or state routes, they may be designated as parts of such roads by proper agreement between such cities or towns and the state hghway commissioner, or the county board.

Article V relates to funds for state highway work, Section 2 of which is as follows:

> All receipts from the following sources shall be paid into and credited to the state highway fund as soon as received:
>
> 1. From the half-mill tax levied under the act adopted by the people of the state Nov. 3, 1914.
> 2. From such appropriations as may, from time to time, be made by the legislature to the state highway fund.
> 3. From all moneys now in or that may hereafter be paid into the internal improvement permanent fund and the internal improvement income fund.
> 4. From all revenues accruing to the state road fund under the provisions of existing legislation from the registration of motor vehicles and from chauffeurs' licenses, and from fines and penalties.
> 5. From all receipts from the sale of bonds that may be authorized by the people of the state for highway purposes.
> 6. From all public donations, including receipts from any allotments or payments made to the state by the federal government or any department of the same, made toward the construction, improvement or maintenance of state highways. All such donations shall be paid to the state treasurer and by him deposted to the credit of the state highway fund for such particular purpose as may be indicated by the donor; provided, however, that the state treasurer shall not receive any gift for such purposes without the approval of the commission.
> 7. Any balance remaining at the time when this act takes effect in the state road fund created by previous legislation, and all receipts accruing to such road fund, and the state highway commission hereby created shall be deemed to have assumed all lawful financial obligations of the state highway commission and advisory board created by the act approved March 17, 1913.

The law provides that the state highway fund shall be available for paying the expenses of administration and salaries, the cost of constructing and maintaining state highways and parts of state routes, and all damages incurred by reason of the location of roads or routes. Money derived from the sale of bonds must be expended only on the work for which the issue was made, not more than 10% being used for administrative and engineering purposes.

The state highway commission, with the recommendation of the commissioner, is required to prepare a budget showing the amount of funds on hand and the obligations against it, the estimated receipts that will be available from all sources, and the estimated cost of proposed work, which must be submitted to the governuor on or before Jan. 1 each year. "The total estimated expenditures contemplated for all purposes of the state highway department for a given year shall not exceed the total estimated available fund." The amount set aside for administrative purposes must not exceed 4% of the estimated available funds, and the amount of engineering and supervision on any work must not exceed 10% of available funds. If within 10 days after the submission of the budget, it is not returned by the governor to the commission it is deemed to be approved by him. The commission by the vote of each member may alter or reject any recommendations made by the governor.

Another law passed by the legislature gives the state highway department authority to cooperate with the United States government in the matter of federal aid in road construction.

About 15 mi. of Modern Highways are to be built in Brooke County, West Virginia, 9 mi. of which are to be of brick, bituminous or concrete construction, and 6 mi. of water bound or tar bound macadam. Bids for the work will be let May 24 at Wellsburg.

The Railroad Grade Crossing Problem in Wisconsin[*]

The Wisconsin Highway Commission is deeply interested in the betterment of road crossing conditions, inasmuch as in the planning and construction of many thousands of miles of highways it is confronted time and again with the problem of improving conditions at grade crossings either by the entire elimination of them by a relocation of the highway or by an overgrade or undergrade crossing or by improving the grade or alignment of the highway approaches to the grade crossing. The Railroad Commission has done all in its power to facilitate our work of this character, but the present statutes need revision to make the best results possible and the following statement of the case and the following recommendations are made with the advice and consent of the Railroad Commission.

A count from the best available plat books indicates that there are, outside of incorporated cities and villages in Wisconsin, a total of 4,741 crossings of highways with railroads and interurban electric lines. An estimate from the records of the Railroad Commission indicates that at 355 of these crossings the highway is carried either over or under the railroad. This would leave 4,386 crossings at grade in Wisconsin at the present time. This is only an approximation but it is close enough for present purposes. A portion of these grade crossings is protected with flagmen, bells, or mechanical devices of some kind, but they must all be considered as grade crossings upon which there are possibilities of accidents.

It is self-evident that every crossing made by a highway with a railroad or interurban line at grade is a point of possible danger, regardless of the character of the crossing or the view from the road up and down the railroad track. Some grade crossings are worse than other crossings, but all grade crossings are bad, and practically all of them sooner or later will take their toll in damages to property and possibly in injury or death to persons. For the 10 years ending June 30, 1915, the records of the Wisconsin Railroad Commission indicate that 253 persons were killed and 649 injured, a total of 902 persons killed or injured in grade crossing accidents in the 10-year period.

The tremendous increase in the use of the automobile has magnified the grade crossing problem many times, in just the same proportion that the use of the public highway in miles per year has been increased by the automobile, although the work of the Railroad Commission in protecting and removing crossings has kept down the accidents per year remarkably well despite the increased traffic.

The Railroad Commission has certain powers conferred upon it to alter and improve grade crossings, and has very materially cooperated with the Highway Commission in securing the elimination or improvement of conditions at such crossings as have been encountered in the work of the Highway Commission. It is certain, however, that, unless many valuable lives are to be lost in Wisconsin in the next few years, it is absolutely essential that this grade crossing problem be attacked with increased vigor and with new methods and larger funds.

In very many cases the situation at one grade crossing is tied up with that at several other grade crossings over the same railroad in the immediate neighborhood, and one proposition cannot be rightly settled unless all the crossings in that immediate neighborhood are considered as a whole and settled at one and the same time.

A pointed instance of the conditions as regards highway grade crossings is the situation between Mount Horeb, in Dane County, and Dodgeville, in Iowa County. The distance between these two points by the Chicago and Northwestern Railroad is 23.9 mi. The main road between these two points, long known as the Old Military Road and later as the Lake to River Road, is the most important road in this section of the state, and on this main road there are, between Dodgeville and Mount Horeb, 16 crossings at grade, 2 crossings under the railroad and 1 crossing over the railroad. In addition, there are 37 roads feeding into this main east and west road, on which roads there are 15 crossings at grade, 1 overhead, and 1 undergrade crossing. These crossings do not include the street crossings in cities and villages not on the main line of travel. This gives a total of 31 grade crossings, 3 under crossings and 2 over crossings, a grand total of 36 crossings of public highways with the railroad in a distance of 23.9 mi. along its tracks.

The Highway Commission has investigated in some detail the road and railroad problem between these points, and it has been found that the crossings above mentioned can, by a reasonable relocation of highways and the installation of under and over crossings at the proper points, be reduced to 16 grade crossings, 2 over crossings and 4 under crossings, a total of 22 crossings as compared to the present 36. Not one grade crossing would be left on the main east and west highway. Three of these under crossings and the 2 over crossings are built at the present time. A more detailed survey of conditions on the side roads would probably enable a further reduction to be made in the total number of crossings.

These crossings are so planned as not to cause anyone to travel a greater distance between any two points and would eliminate all grade crossings on the main line of travel besides radically improving conditions for all local travel to market. Besides this, the newly located highway would be much better as to grade and alignment than the present one. The total cost of all construction and right of way necessary to effect this change in conditions is estimated not to exceed $35,000, and it is hard to conceive any expenditure which would be of more practical benefit, not only to the people of these neighborhoods, but to all of the people in the adjoining counties.

The above is probably an extreme instance, inasmuch as the number of crossings is far in excess of the usual number for the distance, but it serves to point out some of the possibilities of improvement in grade crossing conditions and the possibility of effecting immeasurable benefits at a cost within reason.

The Highway Commission, with the approval of the Railroad Commission, recommends that the Railroad Commission be given power to investigate on its own initiative any highway crossing or group of highway crossings within the state, to settle upon the solution which will meet adequately the expected conditions for all time to come and to distribute the cost in fair proportion between (1) the interurban line, railroad or railroads concerned; (2) the units of government in which the special improvement may lie; (3) the county; and (4) the state.

At present the Railroad Commission does not seem to have the power to charge the public's share of the cost of such work to more than the unit or units of government in which the crossing may be situated, while, as a matter of fact, other units of government and the general public may have a greater interest in the elimination than has the particular unit in which the crossing may lie.

The proposition should be attacked on broader lines, at the same time with the proper restraints, so that at as early a date as possible as many crossings as means permit may be eliminated and the necessary highway changes made.

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[*] From the 3d biennial report of the Wisconsin State Highway Commission for the period from Jan. 1, 1914, to Jan. 1, 1916, with preliminary estimates to Dec. 31, 1916.

One or two states have established special funds for the elimination of grade crossings jointly with the railroads, and this seems justified by the fact that, at least on certain main lines of travel, a very wide range of country is just as much benefited by the reduction in the number of grade crossings as the immediate town, or village, or city, in which they may be situated.

The comprehensive rearrangement of highways to effect a reduction in the number of grade crossings and to facilitate the construction of under crossings and over crossings has (perforce of present statutes) not received the attention it should have received and ought now be taken up. The cost of eliminating any great percentage of these crossings by the usual methods of carrying them above or below the tracks is so large as to make the general use of these methods impracticable in the rural districts. We venture to say that in hundreds of cases the location of highways can be so changed that the crossings will be reduced to a minimum and made at such points as will permit the most economical construction of either under grade or over grade crossings, or at least the highways can be located in such advantageous positions as will make the reduced number of grade crossings as safe as possible for all traffic using them.

We respectfully commend this matter to the attention of the legislature, believing that it is of very great importance to the people of the state.

New Laws for Highway Work in South Dakota

The legislative assembly of South Dakota recently abolished the old law of the state relating to state road administration and substituted therefor an act creating a new state highway deparment and specifying the procedure to be followed in the establishment and construction of highways and bridges with both state and federal funds.

Under this law the department consists of the governor, as ex officio chairman, the state engineer, as ex officio secretary, and a third member to be appointed by the governor on or before July 1, 1917. The latter must possess the qualifications of a civil engineer and must be an experienced road builder. His term of office is two years, at a salary of $3,000. The governor and state engineer, as members the commission, serve without additional compensation. The department is required to hold its meetings and to transact all business in its offices in the state capitol at Pierre.

Outside of the usual requirements for keeping official records, maps and other data relating to the work of the department, which shall be open to public inspection, the duty and authority of the department, as specified in section 5 of the act, is "to supervise, control and direct the building of public roads and bridges for which state or federal aid is granted throughout the State of South Dakota, and in the various counties thereof." In complying with this provision, the department is authorized to "prepare and adopt such rules and regulations for the construction and improvement of public roads and bridges for which state or federal aid is available as shall be most suitable to the requirements thereof, and bring the most practical results to the various parts of the state," and, as further provided in section 6, "shall select and designate such roads as are of general importance to the citizens of the state as state highways, and they shall authorize the construction of and construct said highways, or any portions thereof, and pay for the same out of any funds that may be appropriated for state road building."

In cooperating with the federal government, the state highway department is required, as soon after its organization as practicable, to submit to the Secretary of Agriculture a definite and comprehensive program of road construction for which federal aid is desired for the full period covered by the act of Congress providing that the government shall aid the states in highway construction. General information as to state, county or township laws affecting road construction and maintenance must also be furnished, and in taking up the actual work of construction the state highway department must prepare and submit project statements showing the proposed work for which federal funds are available, and for the construction of such projects as may be approved the department must furnish surveys, plans, specifications and estimates.

While the construction of roads with state or federal aid money must have the approval of the state highway department, the road authorities of any county, township, town or city are not relieved of the duty of locating, repairing or maintaining such public roads or bridges.

The plan of apportionment to counties provides for an equitable division of state or federal funds, "taking into consideration the assessed valuation in each county." At least 80% of the amount collected or raised by levy for road purposes in any county must be spent for such purpose in that county "if application be made for its use upon projects approved within one year from the date of the levy."

The county auditor of each county in South Dakota is required, on or before Aug. 1, 1917, and on or before May 1 of each year thereafter, to submit to the secretary of the state highway department a certified statement of the mileage of public roads, "over which United States mails are transported, including streets and roads in cities or towns having a population as shown by the latest available federal census of less than 2,500, and any portion of any street or road in cities or towns having a population greater than the aforesaid along which the houses average more than 200 ft. apart; also the location, number of miles and description of all roads which the board of county commissioners, or the board, council or commission of any township or town or city having a population of less than 2,500, as shown by the latest available federal census, shall have resolved to construct, reconstruct or improve (further than ordinary maintenance); also all roads for the improvement, construction or reconstruction of which petitions signed by not less than ten taxpayers of the said county shall have filed with the said county auditor, including bridges upon any of said roads, and the amount of money available in the said county and in each organized civil township thereof, for the fiscal year in which said certificate is made, for the construction, reconstruction or improvement of roads or bridges, and the amount which will probably be necessary to be expended for the ordinary maintenance and repair of existig highways in said county, so far as known to the said county auditor."

The state highway department awards all contracts for state and federal aid work after due publication and the usual procedure, the contract being let to the lowest responsible bidder. Notice thereof is given by the secretary of the department to the county auditor of the county in which the work is to be performed, showing the amount to be paid out of the county funds, which notice is presented by the auditor to the board of county commissioners who must make the necessary amount available.

The state highway department is empowered to compel the proper compliance of county or other officers with the provisions of the law in the matter of constructing, repairing and maintaining roads and bridges with state or federal funds, and it is provided that a refusal to so comply with the order of the department, after due process of law, is punishable by a fine of not more than $500, or imprisonment for not more than 6 months, or both.

A penalty of not more than $1,000 or imprisonment for not more than 5 years, or both, is fixed for a violation of the provisions of the law which forbid any member or employee of the state highway department to have a financial interest, directly or indirectly, except as a taxpayer, in any contract for constructing, repairing or maintaining any bridge or road in the State of South Dakota.

As expressed in section 12 of the law, "the state highway department may, if they deem it advisable, authorize the board of county commissioners of all counties, or the proper officers of any civil subdivisions thereof, to do construction work upon any public road or bridge for which state or federal aid is granted and where counties or civil subdivisions are equipped with suitable road machinery, teams or men, the said state highway department shall, where it is in their judgment practicable or economical, so arrange that said appliances, men or teams may be used in work upon public roads or bridges for which federal aid has been granted in said county or civil subdivisions."

Permission is granted to a town board of any civil township to appropriate any portion of township funds available for road or bridge work for aiding in the construction of federal, state or county roads in such township.

Accounting System of the Milwaukee County, Wisconsin, Highway Department*

"Systematize for Efficiency" has been and is the slogan under which this department operates.

We believe we can safely say, without fear of contradiction, that any organization, even though the personnel be experts, cannot long endure without system. We further believe that systematizing highway accounting is something that cannot be taught but rather must gradually be absorbed from the various difficulties that may arise during the season's work.

From the accounting of expenditures approximating $120,000 in 1912 to $787,000 is the problem we were obliged to meet, and the fact that this was successfully accomplished with practically no additional assistance, is sufficient proof that systematizing brings efficiency.

A system was needed that would yield maximum results and at the same time entail as little labor as possible.

When this department was created, the accounting system was installed by the State Highway Commission; that is to say, all the forms, with a few exceptions, were furnished by the state. Uniformity was being practiced by the state and the forms we used were identical with those being furnished the other counties of the state; and while they met with success in other parts, it was found that this county, doing the enormous amount of work that it was, required a new and broader system.

Assisted by the defects and virtues of the old arrangement, and giving just consideration to the problems that had confronted us during the previous season, new forms were drawn up by this department. The points observed were accuracy, completeness and convenience. The system must necessarily be handled with accuracy, for erroneous accounts would be worthless. Completeness not only would be of aid to us in the future but would be of valuable assistance to others contemplating the building of our types of construction. Convenience for the instant location of any details we believed to be always a requisite of a good system. Associated with convenience was the matter of simplicity. We desired the forms to be of such composition as would enable any official to visit the office and inspect the accounts without the assistance of an interpreter. We endeavored to avoid duplication in our recording forms, an evil that prevails in many offices. We wanted a system that would give us the various costs at any time we might wish to use them and at the same time one that would not lead us too far into detail.

A checking account in the name of the highway commissioner was essential in order that labor, freight and minor bills might be promptly paid through this office rather than being obliged to come before the county board and following the usual routine, thus delaying settlement and giving rise to criticism.

As the financial end of this department relates only to expenditures, provisions were made for expenditures only. It is because of this fact, that highway accounting differs so vastly from the ordinary business accounting.

A cash book was drawn up which was adapted to our particular wants and fashioned in such a manner that the various accounts might be distributed directly from the same.

The distribution book embraced all the various accounts we were to have in the immediate future without going too far into detail.

The payroll system was composed of a time sheet kept in the office and cards which were filled in by the foremen of the respective crews. These cards also acted in the capacity of a daily report for the foremen. A special post card acted as the report cards for the inspectors.

As freight was paid by the county for the contractors a complete line of books was necessary.

Books adequate for the accounting of cement purchased by the county were installed. These were subdivided into bridge, culvert and paving accounts. An account was kept of all cement tested both as to the number of barrels and cost and as to the results obtained by the testing bureau.

Numerous other forms were drawn up where it was found that time and labor could be saved by their installation.

This, briefly, gives the system we are following at the present time. New forms are constantly being put into use and old ones being improved upon. Employees are at all times urged to assist in simplifying the system and to offer any criticism or recommendation they may wish to have considered.

NEWS NOTES

The Board of Public Works of Los Angeles, Cal., according to recent advices, has been instructed by the City Council to have all alleys in the city paved with concrete in the future.

Residents of Hughesville, Lycoming County, Pennsylvania, are urging the improvement of about 1 mi. of main roadway in that borough, and it is stated that this work may be done upon request of the county commissioners, who, in conjunction with the Borough, must pay 50% of the cost. It is proposed to send an engineer to inspect the old base of the road to ascertain whether or not it can be resurfaced satisfactorily.

The Levy Court of New Castle County, Delaware, has been authorized by a bill, which was recently signed by the Governor, to borrow $500,000 for constructing a section of the Lincoln Highway from Pennsylvania to the Maryland line by way of Wilmington, Elsmere and Newark. The work of construction will be done under the supervision of the State Highway Department.

The "Lake and River Drive," a proposed highway from Mt. Clemens to Port Huron, Mich., is being promoted by automobile clubs of Detroit and elsewhere in the state, according to reports. The route of the proposed drive is through New Baltimore, Anchorville, Fair Haven, Pearl Beach, Algonac, Cherry Beach, Marine City, St. Clair and Marysville, traversing the fishing and resort section of eastern Michigan.

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*From the 5th Annual report of the Milwaukee County Highway Department, for 1916.

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Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

MAY 12, 1917.

SEACOAST AND BORDER HIGHWAYS FOR MILITARY PURPOSES

More than once during the past few years attention has been called in these columns to the military function of roads. A few weeks ago it was pointed out also that the highways were important in war for other than strictly military purposes—that no small part of the increased production and better distribution of foodstuffs would depend upon the existence of adequate road facilities.

As the immensity and diversity of the tasks before this country in the war it has undertaken are better understood road building appears more and more vital as a defensive measure, for while at present the possibility of invasion or attacks upon the coasts perhaps seem remote, that possibility must not be lost sight of. In this war the possibility of today may be a probability tomorrow and a certainty the day after.

Transcontinental roads and, in general, all roads in the interior of the country connecting points also served by railways can be left out of consideration. The movement of troops and the transportation of munitions and supplies over long distances must be handled by the railroads. Roads along the Atlantic and Pacific coasts, the Gulf of Mexico and the Mexican border are the ones, if any, that are of importance. And that adequate highway facilities are important to successful defensive operations seems to be fairly well agreed.

In one of the December, 1916, issues of "Good Roads" there was printed a review of a paper presented at the 1916 fall convention of the Washington County Engineers' Association at Tacoma, Wash., in which the value of seacoast roads was well illustrated. ["The Highway System as a Military Adjunct," "Good Roads," Dec. 2, 1916, page 226.] The author of the paper, Capt. Arthur P. S. Hyde, C. A. C., U. S A, told of some of the lessons learned on the French frontier and in the Dardanelles campaign and described their application to the defense of the Puget Sound country.

To the lay observer, one of the greatest lessons of the war appears to be the demonstration of the comparative uselessness of forts. Another that was pointed out by Capt. Hyde is the effectiveness of mobile heavy artillery. These two strikingly indicate the great military advantage of an adequate system of highways capable of carrying very heavy traffic. In the fighting at the Dardanelles, according to Capt. Hyde, "Coast defense guns, instead of being permanently emplaced, as has been the rule in the past, were transported from place to place and fired from concealment from the most unexpected locations." Such tactics would be made possible in the defense of either the coasts or the frontiers were proper road systems provided to supplement the railroad facilities.

The seacoast of the United States, including the coast of the Gulf of Mexico, has a total length of approximately 5,000 mi. Adding to this the Mexican border gives a total length of coast and southern frontier of not far from 6,000 mi. What is applicable to the defense of the coast at Puget Sound is equally applicable to miles and miles elsewhere along this enormous coast line.

Assuming then—as the facts appear to warrant—that roads are needed for military purposes along the coasts and frontier, the next step is to ascertain where they are needed, and where the need is most urgent. This work, it would seem, can best be done by the state highway departments cooperating with the coast defense branch of the military—the state highway officials furnishing information as to existing roads and their condition and the military authorities indicating the requirements for defensive work and operations. It is obvious, even to the layman, that little work would be required in some sections and large amounts in others. It would, however, entail a very great loss of energy and funds were the civil authorities to go ahead blindly without the advice of military experts.

Plans for the work having been prepared jointly by the state highway departments and the War Department, the actual work of construction could well be left to the states, using therefor state and federal funds. Convict labor could also be employed to advantage and it might even be found feasible to utilize prisoners of war, as has been advocated in the case of farm work and as, according to reports, has actually been done in Europe. Roads built in this manner, although primarily for war purposes, would be of immense value after the war—undoubtedly of sufficient value to render the cost of construction a profitable investment entirely from a commercial point of view.

Finally, with the unquestioned necessity for having more roads and better roads, not only for marketing and distributing the products of the fields and farms and taking care of the increased production in all lines which the conduct of the war will necessitate, but also military purposes, there seems to be no justification for the curtailment of road work that has been threatened in some localities. On the contrary, there would seem to be every reason for greater activity than ever before. But in its prosecution unusual efforts should be made to secure efficient and economical work, not only to secure good roads at the lowest possible cost but to conserve the materials and labor for which there will be so many other demands.

The Highway System of Grayson County, Texas, contains 360 mi. of gravel, macadam and concrete roads, 237 mi. of which are outside of towns. The system was completed March 17, 1917, and cost $1,750,000. The assessed valuation of the county is $50,000,000.

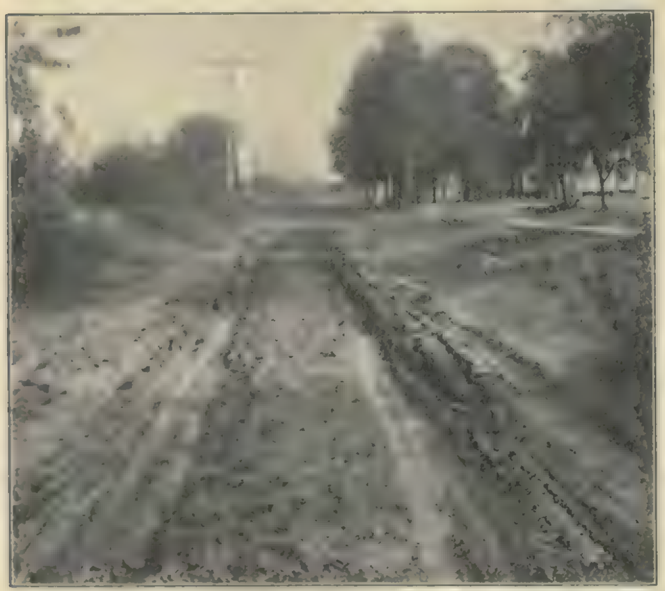
A Bill Has Been Introduced in the New York State Assembly by Assemblyman Donohoe, of Garrison, proposing that a military road 21 mi. in length and 18 ft. in width, be built in Putnam County, at an estimated cost of $300,000. The proposed route would be from the Garrison Ferry house (opposite West Point) eastward, connecting with the Connecticut state road east of Brewster.

Asphaltic Concrete Roads as Developed by the Philadelphia Bureau of Highways

By E. A. TREGO*

Under the administration of William H. Connell, Chief of the Bureau of Highways, Philadelphia has experimented with practically all types of streets and roads. The highway department has been notably successful in the economical construction and maintenance of highways, as well as in the resurfacing of lighter traffic roads, and in the matter of research work was ahead of nearly all municipalities in establishing some years ago what are termed service test roads, these consisting of short sections of various types but constituting an unbroken stretch of highway several miles in length. The test roads run through a farming section some twelve or fourteen miles from City Hall.

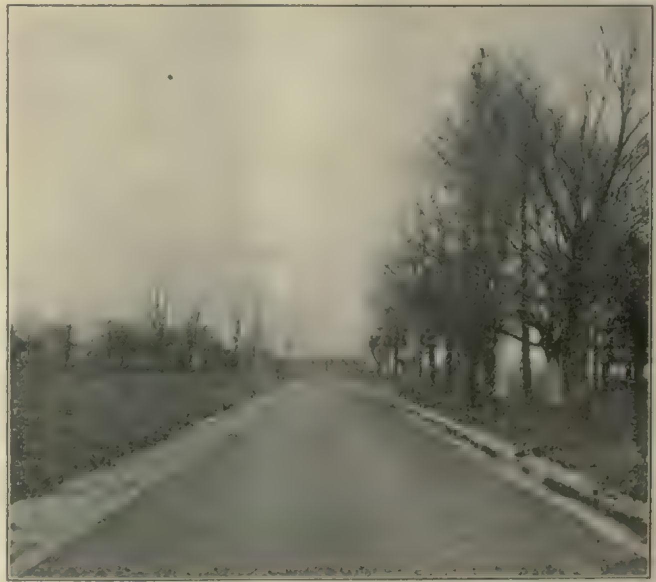
A matter of special interest as it bears upon the country road problem is the adoption of a type of highway which the department regards as a suitable standard for country roads subjected to very heavy traffic. This road consists of a Portland cement concrete base and an asphaltic concrete wearing surface. Having experimented with Portland cement concrete roads and bituminous roads on a broken stone base, it is the conviction of the department that where entirely new roads likely to encounter very heavy traffic are to be constructed, more satisfactory results are likely to be obtained by combining the two types than by using asphalt and cement as customarily used for the separate and distinct types of roads known as the bituminous road and the concrete road. Indeed, so thoroughly convinced is the department as to the utility of the combination road for very heavy traffic conditions that some of these highways have been constructed with a binder course. The department believes that the slight increase in cost occasioned by the use of the binder course is fully warranted where traffic will be extremely heavy.


SOUTHAMPTON ROAD, PHILADELPHIA, PA.—CONDITION BEFORE IMPROVEMENT.

The theory upon which these roads have been given preference has to do with certain defects observed in the separate types of roads. Under heavy traffic a broken stone base of the customary thickness is far more likely to break down than the same thickness of cement concrete. Where this occurs it is accompanied by the collapse of the bituminous wearing surface. A concrete base of 5 or 6 in. is as cheap, if not cheaper than, a stone base of corresponding strength. Its strength is more uniform and being practically a monolith it will bridge any slight depression in the sub-base as well as transmit stresses. The wearing surface of asphaltic construction provides a mudless, dustless road of resilient or slightly yielding nature, as distinguished from a hard and brittle surface. But quite as important is the fact that it prevents buckling and upheaval of the concrete by keeping temperature and moisture conditions more constant. If the base cracks, which frequently happens, the edges of the fractures are not exposed to traffic abrasion, and the road always presents an even and unbroken surface, a surface easily patched or repaired, and one which, after years of service, may be renewed at a moderate cost. Thus these two valuable road materials, asphalt and cement, are confined to the purposes to which they are best adapted.

PREPARING SUBGRADE FOR CONCRETE FOUNDATION—SOUTHAMPTON ROAD, PHILADELPHIA.

The accompanying illustrations show a road of this type built by the Philadelphia Bureau of Highways. It is a typical country road under the jurisdiction of the bureau. It is known as Southampton Road, and the views herewith show sections between Bensalem and Worthington. One illustration shows the character of the original road. Another is a view of another section of the road during the preparation of the subgrade. The third is a view of the finished road and shows the section shown in the first illustration.


COMPLETED ASPHALTIC CONCRETE PAVEMENT ON A CEMENT CONCRETE FOUNDATION—SOUTHAMPTON ROAD.

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* The Barber Asphalt Paving Co., Philadelphia, Pa.

The subgrade was carefully prepared and thoroughly rolled. Upon this was laid a concrete base 5 in. thick, the proportions being 1:3.6 of cement, sand and stone. The wearing surface consists of 2 in. of asphaltic concrete conforming to the following specifications:

Materials	Percentages
Bitumen	7 to 9
Portland cement	8 to 10
Stone: ¾-in., hard, crushed	55 to 60
Sand: coarse to fine	25 to 35
Other ingredients	not over 1

The concrete base cost 61 ct. per sq. yd. and the asphaltic wearing surface 72 ct. per sq. yd., making the total cost of the pavement $1.33 per sq. yd. This was a very low cost considering the fact that the road was completed in May, 1916, when prices for labor and materials were very high.

An unusual feature for a country road was the construction of concrete gutters. On some of the best examples of this type built by the Philadelphia bureau concrete curbs were cast as an integral part of the base.

Concrete Pile Trestle Bridges*

The most common cause for replacing old bridges has been on account of the old abutments and piers being in very bad condition. It is also true that most of the superstructures were too light to be worth re-using, but they might have served for several more years for ordinary wagon loads.

Owing to the limited funds available when these bridges were built, they were made considerably less expensive in first cost by not carrying the footings down well below the bed of the stream. Later the channel changed its course, so that the deepest part came over against one of the abutments or sometimes the whole bed of the stream was gradually cut out and lowered, so that the abutments were undermined.

In the state plans for bridges, the abutments and piers are carried down below probable undermining at a consequent increase in cost for abutment work.

In our search for a type of substructure that would be less expensive and at the same time provide safety against undermining, we found that the railroad companies have adopted the concrete pile trestle bridge to quite an extent and we have studied this type with the idea of using it in highway bridges.

In this form of construction, reinforced concrete piles are cast in forms on the ground and after the concrete has set for about 30 days, the piles are set up on end and driven with a large pile driver. The top of the pile projects above the ground and a concrete cap is cast, surrounding the top of the piles in each bent and forming a support for the superstructure.

The most economical span between the bents for ordinary conditions in highway work is about 20 ft., and the new cellular slab superstructure described in another article in this report is a very economical design to use for this superstructure. No end abutments are used and the bridge consists of enough short spans to provide the proper waterway after allowing the fill to run through the end piles on a 1 to 1 slope with riprap protection.

The bridge is very similar to the wood pile trestle bridges which have given such good service, except that concrete is used throughout, so that the rotting of the piles and joists and the wearing out of the plank floor is eliminated. In locations where it is not feasible to block up the channel with intermediate pile bents, the construction could consist of a long center span carried on a double row of concrete piles with a large concrete cap and with the approaches consisting of concrete pile trestles. Among the advantages of this type of substructure work, one of the most important is the fact that no excavation is necessary for foundations, thereby greatly reducing the cost of construction.

The available working season will practically be doubled in length of time as even a slight rise in water level prevents cofferdam excavation, while the piles can be driven at all stages of water level, except flood stages, which are generally of short duration. This will allow contractors to employ laborers at a time of the year when harvesting is not in progress and fewer laborers will be necessary as more equipment will be used instead.

Bridges of this type can conveniently be increased in length, should more water have to be carried because of extensive new drainage work upstream from such a bridge, as there are no abutments to be replaced by piers.

There have been many cases where old bridges have had to be rebuilt because the abutments have been undermined by a drainage ditch run under the bridge, in which case the bed of the stream was artificially lowered; but with the concrete pile bridge this would not cause any trouble.

These bridges are most economical where a large number are let under one contract, because the cost of shipping the heavy equipment to the territory is distributed and each bridge is charged with only a fractional part of this expense, and this type is especially adapted to the construction of bridges under a bond issue. Already one county has started proceedings to obtain a vote of the taxpayers on the proposition of building 102 bridges the coming season and thereby eliminating the expensive maintenance costs on the old bridges, while they are paying for the new ones.

We have prepared standard plans for this type of construction and have furnished such plans where the counties have grouped ten or twelve bridges to be let at one time

Motor Vehicle Fund in New Jersey

Based on an estimated revenue of $1,500,000 from motor vehicle operation in New Jersey during 1917, the counties will receive the following allotments for road maintenance and repair:

Atlantic, $57,450; Bergen, $94,950; Burlington, $99,150; Camden, $60,150; Cape May, $43,800; Cumberland, $15,750; Essex, $126,600; Gloucester, $63,300; Hudson, $126,600; Hunterdon, $28,500; Mercer, $94,950; Middlesex, $110,700; Monmouth, $116,100; Morris, $100,200; Ocean, $42,150; Passaic, $116,110; Salem, $42,150; Somerset, $45,300; Sussex, $21,150; Union, $63,300; Warren, $31,650.

Bids on Road Work in Pennsylvania Counties

On May 3 the State Highway Department of Pennsylvania opened bids on road work in Dauphin, Cambria, Allegheny and Washington Counties, notice of which appeared in "Good Roads" for April 21.

Stucker Brothers Construction Co., of Harrisburg, Pa., was the only bidder on the work in Dauphin County, the amount of bid being $19,549.05.

In Cambria County, the bidders were: John L. Elder, of Ebensburg, Pa., $183,424.64, and G. T. Morgan, of Johnstown, Pa., $171,412.07.

On the construction of the Allegheny-Washington County road, the Samuel Gamble Co., of Carnegie, Pa., bid $270,473.97. This was the only bid received.

Proposals had been asked also for the construction of a road in Clarion County, but no bids were received on that work.

Action on the above bids will be announced by the department later.

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*From the report of the State Highway Commission of Minnesota for the years 1915-1916.

Nebraska Passes Road Law to Meet Federal Apportionment

The good roads act passed by the 1917 legislature of Nebraska, by means of which the state took advantage of federal aid apportionments to the states, provides for a tax amounting to $640,000 to meet the amount it is entitled to receive from the government, and for establishing a "state aid road fund" for use during the next two years.

The above amount is raised by levying a tax of 65/100 of one mill on each dollar of assessed valuation of the state for the years 1917 and 1918, to be expended in equal amounts. The law provides, however, that if the money is not used during the year for which it was appropriated, it will be available for the succeeding year.

The state aid road fund, deposited with the state treasurer, is at the disposal of the State Board of Irrigation, Highways and Drainage for the improvement of roads and bridges in the state, and to that end it is provided that the board shall cooperate with the federal government and the various counties. The roads and bridges built under the act are free from tolls.

All appropriations for the above purpose from whatever source must be used exclusively for road construction and improvement, and the cost of engineering and administration must not exceed 5% of the total cost of the work.

Apportionments are made to the several counties of the state on the following basis:

One-third in the ratio which the area of each county bears to the total area of the state; one-third in the ratio which the mileage of rural delivery and star routes in each county bears to the total mileage of rurual delivery and star routes in the state; and one-third in the ratio which the population of each county bears to the total population of the state, the latter ratio being determined by the number of votes cast in the respective counties for governor at the general election in 1916.

In preparing a general plan of road work throughout the state, the State Board of Irrigation, Highways and Drainage is required to divide the state into project districts of not more than five counties each, and all statements relating to such projects that are to be submitted to the U. S. Department of Agriculture must first be approved by the county board of each county within any district in which is it proposed to make improvements.

Counties are required to accept by resolution the provisions of the Nebraska road law and provide an adequate fund for the maintenance of highways built by the state before any of the money apportioned to them may be expended, and they are also required to pledge the credit of the county for continuing the maintenance of roads so built. Failure on the part of the county to maintain a road built under the provisions of the law disqualifies it for further participation in the funds so provided, and the state board is directed to withhold its approval of any project and refuse to proceed with any improvement in a county until it has put the highways already built in a proper condition of maintenance.

If the amount of money available under the act is insufficient to pay for the road improvement which is required in any county, upon a majority vote of its residents, the county may levy a tax not exceeding five mills, in the manner prescribed in the revised statutes for issuing bridge bonds, for the purposes of road construction and maintenance; or it may accept and use other funds, such as donations, inheritance taxes, license fees, or special assessments, subject to the approval of the state board.

Any unused funds made available through state and federal aid may be applied to the improvement of other roads within a county than those mentioned in the original district project plan, as may be agreed upon by the state board, the county board and the Secretary of Agriculture.

It is expected that no actual construction work will be done under the new law during 1917, it being the intention of the state board, according to recent advice, to occupy the larger portion of the time in laying out a complete road system and having all surveys and plans prepared and be ready to award contracts early next year. It is also stated that no changes will be made in the highway department but some additions will be made to the surveying forces, and these will be chosen from the territory in which the proposed work is located.

State Highway Commissioner in Ohio

The Supreme Court of Ohio recently decided that Clinton Cowen was entitled to the office of State Highway Commissioner, to which he was appointed for a term of 4 years beginning June 16, 1915. The action of the court was the result of ouster proceedings brought by A. R. Taylor, who was appointed to the office by Gov. Cox in March this year.

Street Work in Philadelphia, Pennsylvania

Street work involving the expenditure of approximately $377,400 has been advertised by the Department of Public Works, Bureau of Highways, of Philadelphia, Pa. Bids will be received on May 15. The schedules which cover operations on a number of streets provide for grading, paving with asphalt, vitrified block and granite block, repaving of the same character, surfacing with penetration macadam and bituminous materials, and resurfacing with macadam, concrete and bituminous materials.

The Commissioners of Reno County, Kansas, Make Tour of Investigation

In view of the proposed improvement of an extensive highway system in Reno County, Kansas, the Board of County Commissioners has recently been making a tour of investigation over the permanent roads of Illinois, Ohio, Indiana and Missouri.

The party which consisted of Peter Deck, of Plevna, J. L. Ball, of Hutchinson, H. J. Astle, of Haven, members of the commission, W. B. Harris, County Engineer, Harry Tidd, representative of the Western Brick Association, Hutchinson, C. H. Scott, of the Hutchinson "News" and Secretary of the Santa Fe Trail Association, and John Schwinn, of the Hutchinson "Gazette," left Hutchinson on Sunday, April 29. At Chicago, G. H. Reiter, Secretary of the Illinois Good Roads Association, conducted them over 30 mi. of roads of various types of construction, including macadam, concrete, asphalt, tarvia, bitulithic and brick on several kinds of base. During their visit to Cleveland, Ohio, they traversed about 1,500 mi. of brick roads in the northern part of the state.

Reno County, Kansas, will soon vote on a proposal to issue bonds approximating $3,000,000 for the purpose of establishing a 150-mi. county highway system.

A State-Wide Campaign for Instituting the Patrol System of Maintenance in Kentucky is being planned by the State Chamber of Commerce, according to a report. Photographs of repair work and of patrolmen will be used to illustrate the value of the plan to the people of the state. Several counties have used the system with success and others are adopting it, and it is said to have the indorsement of the Louisville Automobile Club and public spirited citizens.

MEETINGS

Calendar of Coming Meetings

May 23-24.—Michigan State Good Roads Association—Annual meeting, Saginaw, Mich. Secretary, A. A. Anderson, Hastings, Mich.

June 11.—New York State Conference of Mayors and Other City Officials—Annual Conference, Buffalo, N. Y. Secretary, W. P. Capes, 25 Washington Ave., Albany, N. Y.

June 26-30.—American Society for Testing Materials—Annual meeting, Atlantic City, N. J. Secretary, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

Georgia Society of Wardens and Road Superintendents

The annual meeting of the Georgia Society of Wardens and Road Superintendents will be held at Albany, Ga., on May 23 and 24, and invitations are extended to all county commissioners, road superintendents and other officials of similar position. The meetings of the society are intended to promote the closer cooperation of those who are charged with the handling of the prisoners on road work.

Arrangements for the meeting are in the hands of W. J. Pinson, Superintendent of Dougherty County, who will be assisted by county commissioners and citizens of Albany in planning for the entertainment of visitors.

Pacific Highway Association of North America

At the meeting of the Pacific Highway Association held at Seattle, Wash., April 30, the following resolutions were passed:

I.

Whereas, a highway from British Columbia to Mexico, over which troops can be transported expeditiously, is an absolute necessity for the protection of the Pacific Coast;

And Whereas, Washington has about completed and hard-surfaced her section of the Pacific Highway;

And Whereas,, California will complete her section this year;

And Whereas, Oregon has about 270 mi. that is in poor condition and not hard-surfaced;

And Whereas, the public highway, over which troops may be moved quickly, is the most economical and important factor in modern warfare;

Now, Therefore, Be It Resolved, That the association does most urgently request that the people of Oregon take all necessary steps to provide a way to complete the section through their state immediately, in order that we may unitedly prepare for the common defense of our whole country against every emergency that may arise, for if delay is indulged, the whole nation may be seriously embarrassed by failure of one section to do its part in preparing for the common defense.

And the services of the membership of the association are hereby tendered to the people of Oregon to aid them in every way possible to secure the completion of their portion of the Pacific Highway.

II.

Resolved, That we reaffirm the position heretofore in all conventions taken, as follows:

a. That we are unqualifiedly in favor of constructing at the earliest date possible the great Coastal Military Highway from the British line to Mexico.

b. That the Pacific Highway should be completed at once because it is most important for military movement ,the common defense, and economic development.

c. The water grade highway up the Columbia River on both sides of the great food producing sections of Washington, Montana, Idaho, Oregon, Nevada and California, with one main trunk running south through Oregon into California near the eastern base of the Cascade Mountains, and another north through Washington near the base of the same mountains into British Columbia, are indispensable in connection with the other two, and for these three important arterial highways we unitedly stand.

III.

Resolved, That it is a matter of urgent importance and necessity to have constructed a miltary highway from British Columbia, through the states of Washington, Oregon and California, along or near the coast, to Mexico, and that Congress, or other competent authority, be and hereby is urgently requested to make provision for the construction of such a military highway at the earliest date practicable. That Samuel Hill and Frank Terrace of Washington, C. S. Jackson and Simon Benson of Oregon, and F. W. Kellogg and H. L. Titus of California be and they are herby accredited as delegates of this association, to present the urgency of this matter to the President of the United States and the Congress, and this committee be continued to examine bills that have been presented to Congress, with a view of furthering this military highway.

IV.

Resolved, That our president be given full power, in correspondence with members throughout the district, to complete all the necessary conditions to carry on the executive work.

Samuel Hill, President of the association, suggests that readers of the foregoing write letters immediately to senators and representatives in Congress urging immediate action in the matter of the construction of this coastal military highway.

National Conference on City Planning

The Ninth National Conference on City Planning was held at Kansas City, Mo., on Monday, Tuesday and Wednesday of this week. At the afternoon and evening sessions on Monday a number of addresses were made by men prominently connected with highway development. Among them were Nelson P. Lewis, Chief Engineer of the Board of Estimate and Apportionment, New York City; Curtis Hill, City Engineer of Kansas City, and W. H. Dunn, Superintendent of Parks of that city, who spoke on the subject of the "Relation of Traffic Ways to Parks and Boulevards."

George E. Kessler, who presided at the morning and afternoon sessions Monday, presented a paper in the evening on "Kansas City's Park System and Its Effect on the City Plan." Frederick Law Olmsted, President of the National Conference on City Planning, spoke of the needs of Kansas City with especial reference to the treatment of water courses.

Delegates and visitors to the convention were accorded an enthusiastic welcome by the city.

NEWS NOTES

Precinct No. 4, of Kendall County, Texas, recently passed by a majority of six votes a bond issue of $80,000 for road improvement.

Contracts for Street Paving in Norfolk, Va., aggregating about $80,000, have been let for 33,795 yds. of sheet asphalt and 4,520 yd. of wood block paving.

The Ardsley Park-Irvington-Tarrytown Section of the Albany Post Road in New York is to be reconstructed. The work, it is understood, will probably necessitate the closing of the road during the greater part of the summer.

The Commissioners of Mercer County, Pennsylvania, are endeavoring to secure the construction of a through road about 28 mi. in length, commencing at New Wilmington and extending through Mercer and Greenville to the Crawford County line, on Route 82. The county agrees to assume one-half of the cost of the proposed construction.

EQUIPMENT — TRADE — MATERIALS

"About Culverts"

A new booklet issued under the above title relates chiefly to the use of vitrified clay pipe for culverts and side drains. The basic principles and types of culvert construction, sizes of pipe, vitrified clay pipe for road drainage, and how to build permanent culverts are the subjects treated in separate sections of the book, and are well illustrated by halftones and diagrams. It also contains a comprehensive article on "Culvert Design" by F. P. Sheidler, Engineer of the Ohio Highway Commission, reprinted with diagrams from the proceedings of the Ohio Engineering Society.

The booklet is issued by The Sewer Pipe Manufacturers' Association, Second National Building, Akron, Ohio.

Large Sale of Garford Tractors

The Garford Motor Truck Co. has recently secured an order calling for the delivery of 34 Garford tractors to the New York City Department of Street Cleaning. The order amounts to nearly $200,000.

The tractors are to be used during the day for hauling trailers for the removal of ashes, street refuse and garbage and at night for hauling and operating street flushing and cleaning machines. In the winter they will also be used in snow removal work. It is stated that the trucks will be operated an average of 16 hours a day and will haul loads up to 15 tons.

"Reducing Ultimate Culvert Costs"

"Reducing Ultimate Culvert Costs" is the title of a booklet recently issued by the U. S. Cast Iron Pipe and Foundry Co., of Burlington, N. J. The contents include a treatise on culvert pipe, its manufacture, design and use, with tables showing dimensions and prices of the cast iron culverts made by the company. There are also included sketches and dimensions of highway, railroad and bridge signs of iron. The booklet is 3½x6 in. in size and consists of 24 pages and covers. It is printed on paper of good quality, in two colors, and profusely illustrated by halftones showing culvert pipe and culvert installations and by reproductions of drawings illustrating methods of laying.

The Gramm-Bernstein Sales Corporation has been incorporated to handle Gramm-Bernstein trucks in the eastern territory, succeeding the R. E. Taylor Corporation, in New York City. The service station in New York will be continued, and a new service station will be opened at 1110 Commonwealth Ave., Boston, Mass. The capital of the new corporation is $50,000.

The Copeland-Inglis Shale Brick Co., of Birmingham, Ala., has become a licensee of the Dunn Wire-Cut Lug Brick Co., of Conneaut, Ohio, and will engage in the manufacture of wire-cut lug paving brick. The company is one of the largest and most important paving brick concerns in the South. Beattie A. Inglis is Vice President and Treasurer, and W. Lawton Inglis is Secretary.

"Would You Hitch a Wagon to a Kangaroo?" is the inscription on the outside of a folder recently issued by the Duplex Truck Co. of Lansing Mich., to describe the use of the four-wheel drive which is a feature of the Duplex truck. The folder is printed in colors and illustrated by three halftone views of Duplex trucks operating under difficult conditions. The text is devoted to a brief description of the truck and its operation.

The Branley-Lanham Paving Co. has been incorporated in Dallas, Texas, with a capital stock of $100,000, to engage in the construction of roads and bridges.

The J. I. Case Threshing Machine Co., of Racine, Wis., is distributing blotters carrying on one side a cut of a Case tractor and a list of the uses to which the machine may be put. The printed side of the blotters is done in three colors.

PUBLICATIONS

CALIFORNIA RAILROAD COMMISSION. Bulletin of the Progress of the Commission's Investigations of Railroad Grade Crossings in the State. April, 1917. Paper, 6x8¾ ins.; 21 pp. and covers.

The contents of this bulletin comprise a detailed discussion of the work of investigation carried on by the California Railroad Commission of railroad grade crossings in the state and of the work accomplished. There are also included several drawings showing proposed methods of making grade crossings less dangerous

MILWAUKEE COUNTY, WISCONSIN, County Highway Commissioner, 5th Annual Report. Paper, 6x9 ins.; 93 pp.; illustrated.

Included in this report are sections on the organization of the department, report forms, the development of the county highway system, accounting, surveys and plans, records, traffic, freight handling, cement testing, sheet asphalt inspection, materials, specifications, maintenance, and other matters, and a number of pages of statistics on the work done in construction and maintenance, with costs. The illustrations include portraits of the county road and bridge officials and views showing road and bridge work in progress and completed.

PERSONAL NOTES

A. R. Coffeen has been appointed City Engineer of Riceville, Ia.

W. D. Howren has been appointed City Engineer of Amarillo, Texas.

A. D. Armstrong has been appointed City Manager of Amarillo, Texas, to succeed M. H. Hardin, resigned.

Dr. Frederick A. Cleveland has resigned as Director of the Bureau of Municipal Research, New York City, but will continue to act in a consulting capacity for the bureau.

S. D. Newton, formerly City Engineer of Knoxville, Tenn., has been made City Engineer of Cleveland, Tenn. Mr. Newton has recently been engaged in the practice of civil engineering in Charlotte, N. C.

Guy Robert Ramsey, Assoc. M. Am. Soc. C. E., of Orlando, Fla., has joined the engineering staff of the Dunn Wire-Cut Lug Brick Co., of Conneaut, Ohio, as Division Engineer for the southern states, with headquarters at Atlanta, Ga. Mr. Ramsey was formerly City Engineer of Orlando, Fla., and Highway Engineer of Orange, Osceola and Seminole counties, Florida.

GOOD ROADS

A Weekly Journal of Road and Street Engineering and Contracting

Old Series, Vol. LI.
New Series, Vol. XIII.

NEW YORK, MAY 19, 1917

Number 20

Methods of Determining the Road Making Qualities of Deposits of Stone and Gravel*

By L. REINECKE†

The Department of Mines of Canada has been engaged in examining occurrences of stone and gravel available for road construction since the summer of 1914.

The purpose of this paper is to outline the methods that have been used in arriving at the relative values of the deposits in any given area.

Up to the present surveys have been confined to the provinces of Ontario, Quebec and New Brunswick. Prospecting for first-class stone has been undertaken along certain navigable waterways, but most of the work has consisted of mapping and determining the quality of all deposits of bedrock, glacial stone and gravel, within hauling distance of certain highway routes and, in certain cases, over large areas.

Areal surveys have been undertaken near St. John and Moncton, New Brunswick; in Two Mountains and Soulanges Counties, Quebec; in Kent and Essex Counties, and in part of Carleton County, Ontario. Belts of country adjoining 270 mi. of the 560-mi. length of the Windsor-Toronto-Montreal Highway and 150 mi. of the 175-mi. length of the Prescott-Ottawa-Montreal Highway have been examined and mapped.

The usefulness of work of this kind to the road builder is dependent in large degree on the accuracy with which the road making value of the materials is determined, and it is in the hope of receiving suggestive criticism regarding the methods used that this outline is presented.

Three classes of road material—bedrock, bowlder deposits and gravel—are encountered in this work and each has its own problems.

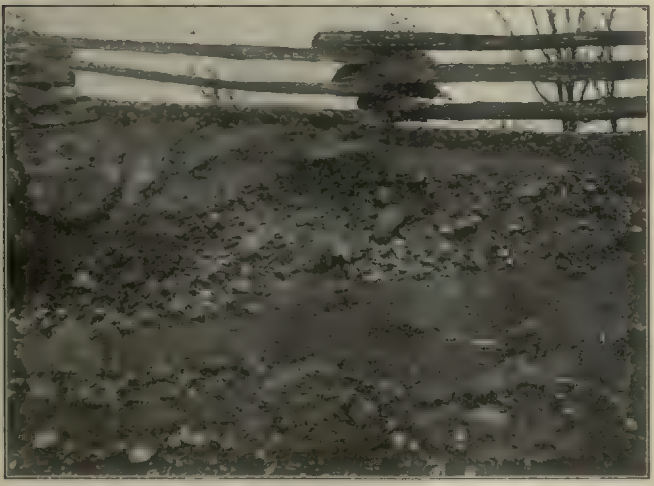

FIG. 1.—BANK OF GOOD CONCRETE GRAVEL NEAR KEMPTVILLE, ONT.

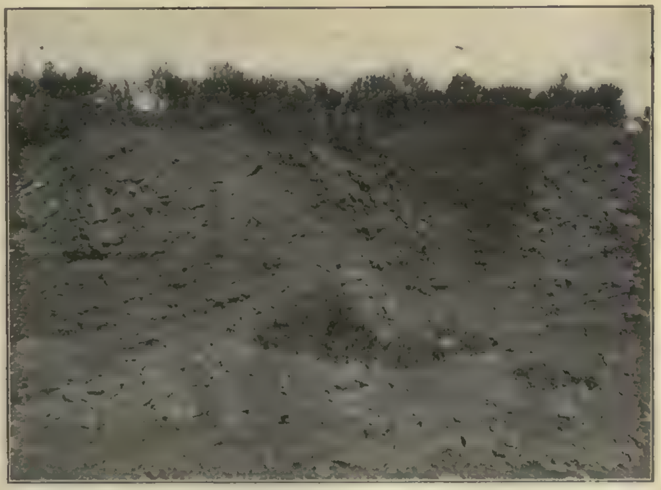

FIG. 2.—A BANK OF POOR CONCRETE GRAVEL NEAR OTTAWA, ONT.

Bedrock

A certain amount of general information is gathered regarding nearly all bedrock occurrences, but our main concern is to first classify the bedrock according to its road making value, and then to study the different classes to find the causes of variation in strength and to determine the distinguishing marks of good stone. Knowing these the field man is enabled to classify the many occurrences of bedrock that cannot be tested.

The route survey along the north shore of Ottawa River, between Hull and Montreal, will serve as an example of the information obtained regarding bedrock. In this instance areas of bedrock lying within 2 mi. of the road were mapped and numbered. In the report, detailed information regarding the stone is given under numbers corresponding to numbered areas on the accompanying map. The photograph, Fig. 3, for instance, is an example of a diabase dike, deposit, No. 158 on the map. The information given regarding it includes a description of its quality, the statement that about 100,000 cu. yd. of diabase can be obtained from the deposit above ground water level, that it be can economically quarried, and is about 2 mi. from the proposed highway and a railroad.

Determination of Relative Value

In order to discover the relative quality of the stone available in the area, the rocks were first divided into geological formations and the formations into rock types. Rocks made of the same mineral particles, under the same conditions, at about the same time, and subjected since then to the same earth stresses, are, under this system, grouped together. Certain of the groups, from the previous experience of road builders with material of a similar kind, can be at once rejected. In this area after rejecting certain soft, coarse crystalline limestones, friable sandstones and much altered gneiss as unfit for road work, there remained six classes of stone. Several samples of each of these were then tested in the laboratory and their behavior under the action of traffic studied wherever that was possible. Upon the results of the tests, modified by data regarding the uniformity of the product obtainable and by other considerations, decisions regarding the usefulness of the rock types in road surfaces were based.

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*Paper presented at the Fourth Canadian and International Good Roads Congress, Ottawa, Ont., April 10-14, 1917.

†Geological Survey, Canadian Department of Mines.

Laboratory and Service Tests

A digression may be made here to discuss the laboratory and service tests. Of the five standard tests performed in the laboratory, the most important are those of per cent. of wear or abrasion, toughness, and cementing value. The standard methods of making the tests have been fully described by Jackson. (a) They simulate the action of traffic on fragments of broken stone in a roadbed. Loads passing over a broken stone road abrade the fragments at the surface, and cause slight movement and internal abrasion between the fragments in the road mass. The blows of horses' hoofs and of swiftly moving vehicles bouncing from small obstructions on the surface test the toughness of the stone. The pressure of loads and the action of rain water cause the upper surface to cement into a solid mass, and this bond is in turn destroyed by winds on a dry road surface, and by the frictional pull and elastic rebound of rubber tires.

Laboratory tests are arbitrary, but they are uniform and standard, and, therefore, afford a means for comparing rocks. A fair comparison between two kinds of stone under actual service conditions can scarcely be obtained unless the roads on which they are used are constructed under somewhat similar conditions and have had to bear about the same kind and amount of traffic. Where road building has just begun such a means of comparing two types of stone are in most instances not available. The comparison of laboratory and service tests has enabled engineers to specify certain laboratory values for stone to be used under certain conditions of traffic and on certain road surfaces. Thus the lowest allowable toughness for stone in the surface of water bound macadam is placed at 6, the highest allowable per cent. of wear at 5. (b) For moderately heavy traffic the stone should have a toughness of from 10 to 18 and for traffic of 250 vehicles per day and over, over 18. (c) For bituminous macadam, which is generally used only when the traffic is fairly heavy, a minimum toughness of 13 and a maximum wear of 3.7 is called for. (d)

In Fig. 4 the results of tests for toughness and wear upon three of the better classes of stone that are found near the Montreal-Hull Road are shown graphically. The limiting toughness and per cent. of wear of stone suitable for water bound and bituminous macadam are indicated by heavy lines in the figure. It is evident that the strength of the samples of augite-syenite-gneiss and of the diabase are about equal and that both give much better results than granite gneiss. In judging of the relative values of the three classes, however, diabase is placed before augite-syenite-gneiss, because the stone in a deposit of diabase is more uniform in quality than the gneiss. On the other hand, when granite gneiss is the only stone available for a certain stretch of road, the more massive and less altered portion of the deposit is recommended.

When it is possible to separate geological formations into areas as in the case of part of the Ottawa-Prescott survey, the outcrops within whole areas may, in many cases, be at once rejected. The formations in this neighborhood consist of bedded sediments, dolomites, limestones, shales and sandstones, and the stone worth considering occurs in four formations. A number of samples were tested from each, and compared in the manner indicated above for the Hull-Montreal route. It was found that certain dolomites and calcareous sandstones of the Beekmantown formation gave uniformly better results than the others. They were, therefore, recommended as the best available local material. Service tests substantiate this conclusion. Where dolomite is used on the roads near Ottawa it has stood up well in certain instances under traffic up to about 200 vehicles per day. The limestones of the Chazy, Black River and Trenton formations, on the other hand, which are commonly used near and in Ottawa, usually wear to dust and holes rapidly under similar conditions of traffic.

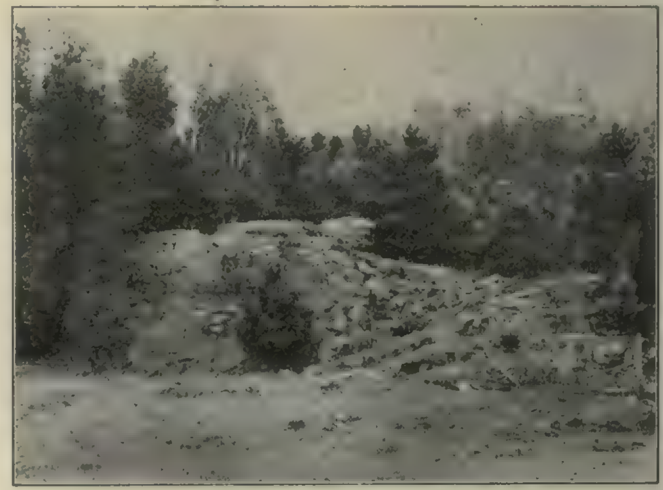

FIG. 3.—DEPOSIT OF DIABASE NEAR THE MONTREAL-HULL-OTTAWA ROAD.

Causes of Differences in Value

The method of laboratory tests has the disadvantage that usually only one out of five or ten of the deposits examined in the field can be tested, and the sample tested is only a small portion of a large deposit. More frequent and close sampling is not often practicable, and the results of the tests are in many cases not available until after the field work is done. For efficient work, therefore, it is necessary for the field man to know the distinguishing marks of a good road stone, and the best way to arrive at them is to discover the causes of the difference in strength and cementing value of stone. For this purpose both the microscope and chemical analyses are used. Careful and extensive comparison of the microscopic texture with the results of laboratory tests upon road stones have been carried on at the office of Public Roads at Washington. (e) The results of this work have furnished a basis for classifying the main rock classes in regard to their road building qualities. But just as men of the same race and age differ greatly in their powers of endurance and their capacities for absorbing food, for instance, so rocks of the same class vary in strength and cementing value. The charac-

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(a) Jackson, Frank H., Jr., "Methods for the Determination of the Physical Properties of Road Building Rock," U. S. Department of Agriculture, Bulletin 347, Washington, D. C.

(b) "Progress Report of the Special Committee on Materials for Road Construction and on Standards for their Test and Use." Amer. Soc. Civil Engineers, Proceedings of the Annual meeting, June, 1917, p. 1621.

(c) Hubbard, Prevost, and Jackson, F. H., Jr., "Relation Between Properties of Toughness and Hardness of Road Building Rocks." Journ. Agric. Research, Washington, D. C., Feb., 1916, p. [illegible]

(d) "Specifications for Broken Stone and Gravel Roads," adopted Oct., 1914, by Amer. Soc. Municipal Improvements, Indianapolis, Ind., p. 7.

(e) Lord, E. C. E., "Relation of Mineral Composition and Rock Structure to the Physical Properties of Road Materials." U. S. Dept. Agric. Bulletin 348, 26 pp. 1916.

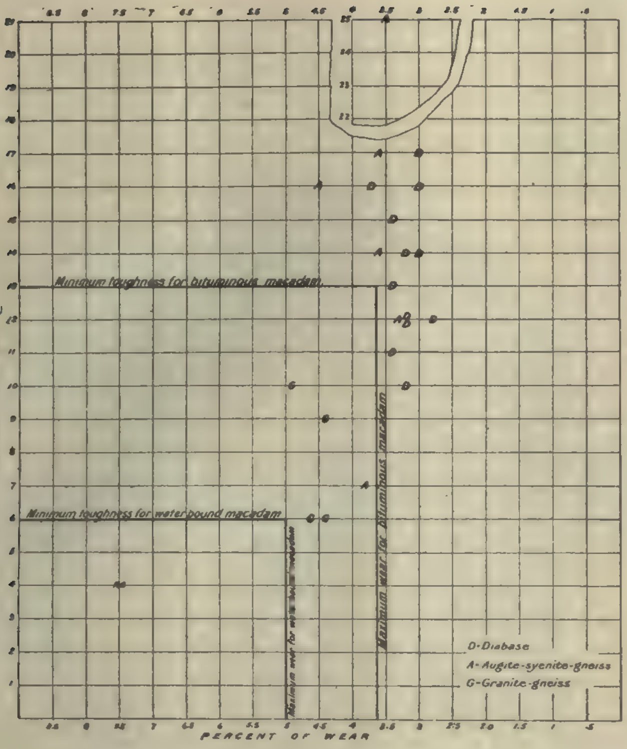

FIG. 4.—DIAGRAM SHOWING THE RELATIVE PERCENTAGES OF WEAR AND THE TOUGHNESS VALUES OF THE THREE CLASSES OF STONE OCCURRING MOST ABUNDANTLY NEAR THE MONTREAL-HULL ROAD.

teristics of the rocks in each particular field must, therefore, be studied in order to do effective work.

In the two thin rock sections shown in Figs. 6 and 7, the cause of the greater strength of the calcareous sandstone associated with the Beekmantown dolomite over that of the sandstone without lime cement is apparently caused by secondary crystalline or angular outline, and to the calcareous cement which fills all voids in the rock, even cracks of .0003 in. wide, as shown in Fig. 7. This lime cement, which is the principal cause of the difference in strength, can be recognized in the outcrop and is, therefore, a help to the field man in selecting the better rock in the field.

A comparison of the thin sections of Beekmantown dolomite with Trenton limestones, Figs. 8 and 9, shows that the dolomite consists of dark grains of even size, packed closely together; the limestones consist of dark, irregular grains loosely held together by white grains. All of the grains in these specimens are made up of the minerals dolomite and calcite, which cleave easily in three directions. In the uneven, coarse grained rocks, the cleavages in the large white grains form relatively large planes of weakness, a fitting starting place for cracks in the rock; in the fine, even grained dolomite, the short cleavage in one grain is usually in a different plane from that in the adjacent grain and an incipient crack starts with a rough surface and does not form as easily. It is inferred also that impurities such as those in the dark grains tend to prevent slipping along the cleavage planes and so strengthen the rock. Chemical analysis and the weathering of the stone prove that the impurity in dolomite is extremely fine silica, in the form of silt. In this region, then, fine, compact, even-grained dolomites, that weather to silt can be considered by the field man to be of better road making quality than limestone of irregular texture.

In the case of the gneisses referred to before as occurring along the Hull-Montreal route, microscopic work revealed that the mineral augite was almost invariably present in the more durable gneisses. In this area, therefore, augite could be used to identify the better classes of gneissic rocks. These instances are cited to indicate the line along which work upon the strength of the stone will proceed in the future. Chemical work to determine the causes for the variation in cementing value has been begun, but has not so far yielded results of value.

Bowlder Deposits or Fieldstone

Fieldstone or glacial bowlders are found piled in fences and heaps in cleared farming country and form an important source of road material. The fences are grouped into numbered areas on the map and the information regarding them compiled in a table. The table gives the yardage present in any area and the average composition of the bowlder aggregates. The composition is an average of estimates of composition made for practically every fence; the yardage is measured, fence by fence, and compiled for the area. Here again the problem is to distinguish between bowlder aggregates that will make good road surfaces and those that will not. The aggregates are, except in rare instances, made up of a number of rocks varying in character. They have been grouped in this area into "hard," "limestone" and "soft," the hard being made up of rock classes considered of good, the limestone of intermediate and the soft stone of poor wearing quality. The presumption is that the durability of the stone in a road surface depends on the relative amounts of these three classes present in the aggregate. In the case of the Ottawa-Prescott route area there is evidently a relation between the amount of soft bowlders and the percentage of wear, Fig. 5, but this relation, based on the same classification, does not hold in other districts, and in later field work in other areas bowlder aggregates have been regrouped into "durable," "intermediate" and "soft," according to the average percentage of wear of the class of rock to which they belong, the limiting maximum per cent. of wear for intermediate being placed at 5.6 and for durable at 3.9. Durable and intermediate include, roughly, stone that would satisfy the requirements of bituminous and water bound macadam respectively as indicated in Fig. 4.

Experiments are being carried on in the laboratory of the Department of Mines to determine the per cent. of wear of aggregates consisting of various proportions of durable, intermediate and soft rocks, as defined above. The idea is to find standards by which the durability of a bowlder aggregate may be judged in the field. It is necessary for the field man

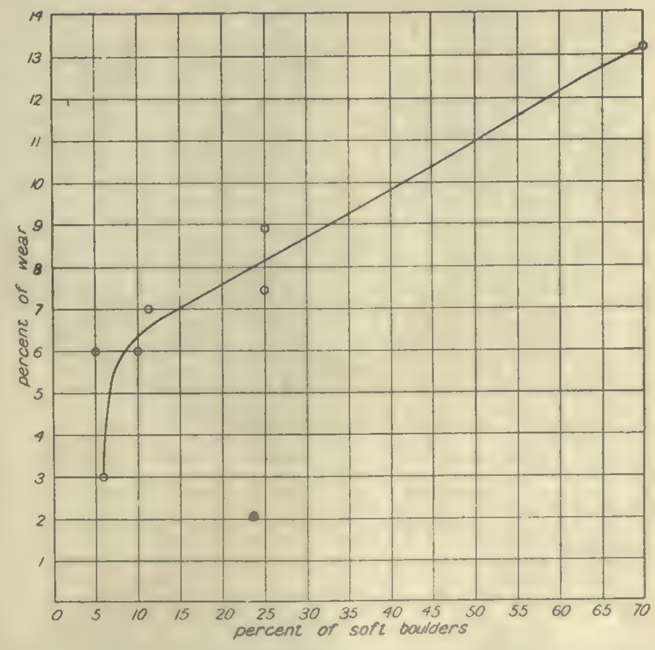

FIG. 5.—DIAGRAM SHOWING THE RELATION BETWEEN THE AMOUNT OF SOFT BOWLDERS PRESENT IN FIELDSTONE AGGREGATES OCCURRING SOUTH OF OTTAWA, ONT., AND THEIR PERCENTAGE OF WEAR.

to have some idea of the relative durability of the bedrock from which these bowlders come, before he can use this classification to advantage in the field. Because of the many miles of road that will have to be built of crushed fieldstone in Canada, it would seem that results along this line will be of value.

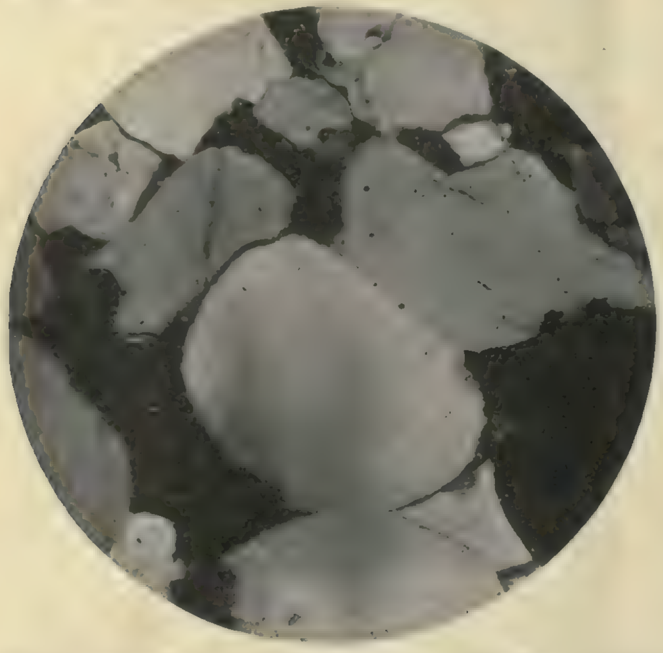

FIG. 6.—THIN SECTION OF POTSDAM SANDSTONE—TOUGHNESS, 4; PER CENT. OF WEAR, 8—THE LARGE DARK AREAS AS WELL AS THE WHITE ONES ARE SAND GRAINS; THE BLACK LINES BETWEEN THE GRAINS ARE THE VOIDS IN THE ROCK—VIEW ENLARGED TO ABOUT 40 TIMES ACTUAL SIZE.

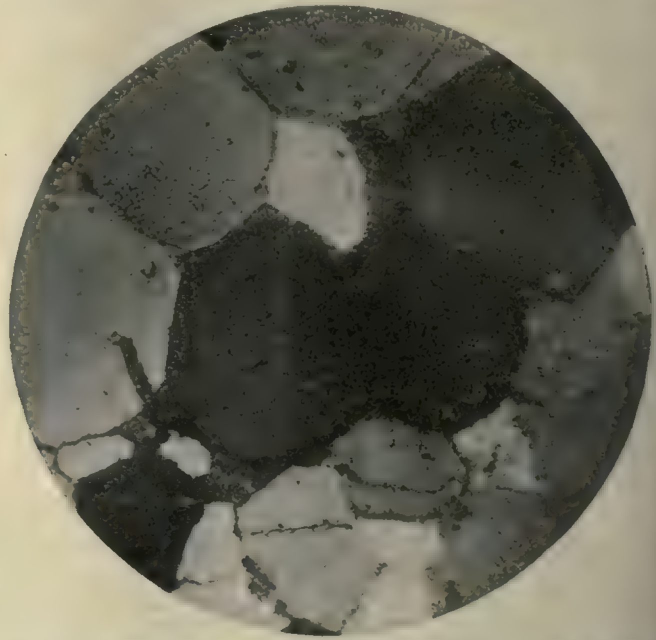

FIG. 7.—THIN SECTION OF CALCAREOUS SANDSTONE, BEEKMANTOWN FORMATION—TOUGHNESS 8; PER CENT. OF WEAR 3.6—ORIGINAL ROUND SAND GRAINS HAVE BECOME ANGULAR BY CRYSTALLINE GROWTH OF SILICA IN VOIDS; ALL OTHER VOIDS FILLED WITH LIME CEMENT—ENLARGED ABOUT 50 TIMES.

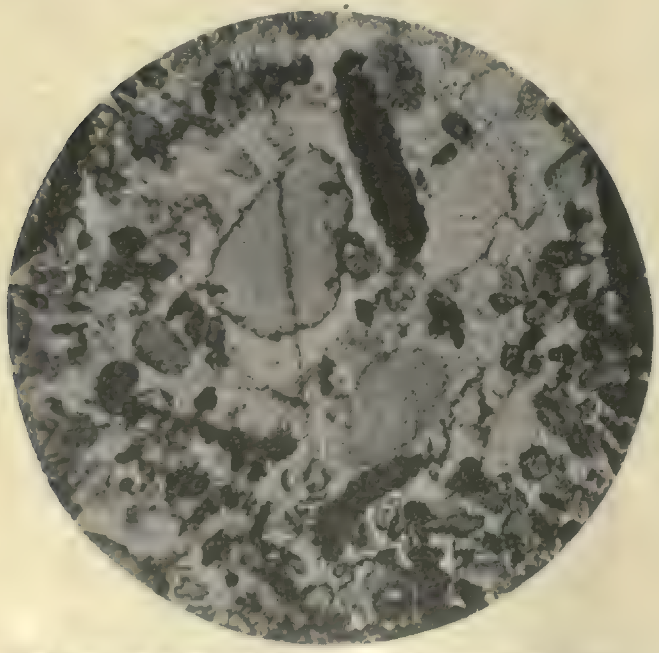

FIG. 8.—THIN SECTION OF TRENTON LIMESTONE—TOUGHNESS 4; PER CENT. OF WEAR 4.7—NOTE THE DARK AND LIGHT GRAINS OF CALCITE AND THE LONG CRACKS ALONG CLEAVAGE PLANES—ENLARGED ABOUT 20 TIMES.

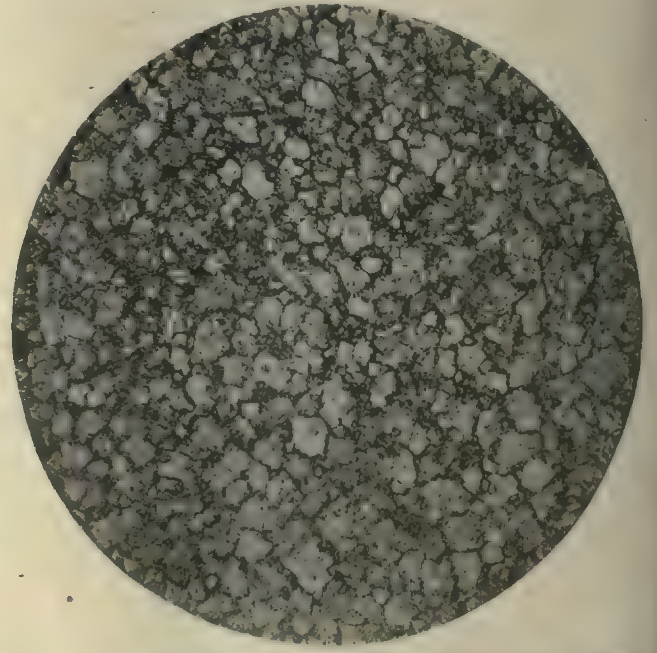

FIG. 9.—THIN SECTION OF BEEKMANTOWN DOLOMITE—TOUGHNESS 13; PER CENT. OF WEAR 4.4—THE DIRTY GRAINS OF DOLOMITE ARE OF ABOUT THE SAME SIZE AND CLOSELY PACKED TOGETHER—ENLARGED ABOUT 100 TIMES.

Gravel

Gravel is perhaps the most difficult of the deposits with which we have to deal. Gravel areas are mapped in the field and numbered in the same way as the bedrock and fieldstone areas, the numbers differing in color for each of the three kinds. Information regarding the gravels is compiled in two tables, one describing the character of the gravel, the other giving information regarding its exploitation and uses. In the table dealing with the character of the deposits, depth of weathering, texture or grading of sizes, impurities, and pebble composition are given. The relative amounts of bowlders, gravel and sand as given are correct only for the pits examined. Gravel deposits vary so much throughout their extent that an average of the texture cannot be obtained except by sinking test pits or auger holes. Except in the case of the silt content, no field method has been devised as yet for estimating the percentage of impurities present. There is great need here for laboratory and field work, because of the importance of the influence of the impurities and fine silt content upon the strength of concrete and in sheet asphalt work.

The gravels are tested in the laboratory for abrasion and cementing value and a mechanical analysis is made to determine the proportions of the different sizes present below 3 in. An attempt has been made to trace a relationship between pebble composition and laboratory tests upon wear. A broad relation was established between the percentage of soft pebbles in the gravel and the percentage of wear, but it is by no means a close one, and since the work was done we have changed our system of pebble classification in the endeavor to evolve some scheme whereby an estimate of pebble composition would enable the field man to predict more closely the durability of the gravel he was examining. It should be stated that the present standard methods for making the abrasion test for gravel are not wholly satisfactory, and the wear of the gravels on roads has in certain instances confirmed the conclusions drawn from their pebble composition rather than from the results of laboratory tests. Figs. 1 and 2 illustrate a good concrete gravel and a poor gravel deposit near the Ottawa-Prescott Road.

As this outline indicates, many of the methods used for determining the value of road materials are far from satisfactory, and we believe that improvements may be affected by close cooperation both with those engaged in road building and with men who are testing stone and gravel in other laboratories. The writer very gratefully acknowledges the courtesy and help he has received from road engineers and especially from the Ontario Highway Department. He is no less indebted to the men in charge of the testing laboratories of the Office of Public Roads in Washington and at Columbia University, with whom our laboratory is now cooperating in work looking toward the general improvement of the laboratory tests upon road stone and gravel.

Summary

In order to determine the road making values of the rocks in a certain district, they are first divided into formations and then into rock types; their average values and the variation in strength and cementing value of each type is obtained by laboratory tests on a number of samples and the results thus obtained are compared with actual service tests in the roads wherever possible. Laboratory studies with the microscope and by chemical analyses are then undertaken to discover the cause of such variations in order to furnish data which will enable the field man to distinguish a good stone from a poor one in the outcrop. With a working knowledge of the strength of the bedrock in a district, an attempt is made to devise a classification of the kinds of bowlders in the fieldstone deposits in such a way that their composition expressed in percentages of durable, intermediate and soft bowlders will bear a direct relation to their percentage of wear, as determined in the laboratory, and to their durability under traffic conditions. The pebbles in the gravels of the district are classified in a manner that will bring about the same result. The impurities present and the texture or grading of the gravels are studied in order to furnish advanced data as to their probable value in concrete and sheet asphalt work.

Eastern Tennessee to Improve Large Mileage

Two thousand miles of new roads are to be constructed in the eastern counties of Tennessee during the spring and summer, according to a report from Knoxville. Road bond issues have been voted and sold in several counties, and are for sale in other counties. It is expected that the following amounts will be expended on highways in the counties named: Campbell, $200,000; Claiborne, $150,000; Grainger, $150,000; Greene, $510,000; Hawkins, $250,000; James, $80,000; Jefferson, $200,000; Johnson, $200,000; McMinn, $300,000; Morgan, $200,000; Polk, $35,000; Scott, $325,000; Unicol, $100,000; Union, $50,000; Washington $750,000.

Highway Legislation in Texas

The Texas legislature has passed three laws concerning highways. One, noted in "Good Roads" for March 29, creates a state highway department, another provides for cooperation with the federal government in carrying out the provisions of the federal aid act, and the third regulates the use of motor vehicles.

The state highway commission is to consist of three members appointed by the governor, for two year terms, and their compensation is fixed at $10 per day when attending to the business of the department, the total compensation not to exceed $1,000 in any one year, in addition to necessary traveling expenses.

The members of the commission are to elect a state highway engineer, who shall be a competent civil engineer, a graduate of some first-class school of civil engineering and experienced and skilled in the construction and maintenance of highways. He is to receive an adequate salary, in the discretion of the commission, and to hold his position until removed by the commission.

As soon as practicable the department is to plan a comprehensive system of state highways, and the commissioners' courts of the various counties are directed to assist in this work by preparing county road maps and furnishing information regarding available road materials, etc.

One of the duties of the highway commission is to adopt rules to determine the fitness of engineers applying for positions in charge of construction work for counties and road districts, and upon the formal application of any county, road district, or municipality, the commission may recommend for appointment someone who is a competent civil engineer, a graduate of some first-class school of civil engineering, and skilled in highway construction and maintenance.

On approved projects, which form part of the proposed state highway system, the state will pay a maximum of one-fourth of the cost of construction, except that in certain cases where the county valuation is very low the state may pay one-half. Not more than 10 mi. of state aid road can be built in any one county in one year. These roads must be built under the supervision of the state engineer, and they must be maintained by the counties. Any county failing to properly maintain state aid roads will forfeit the right to further aid.

The state highway department is to make use of the road laboratories of the Agricultural and Mechanical College and the State University.

The law provides for the use of state convicts in the construction and maintenance of state highways upon such terms as may be agreed upon by the state highway commission and the state prison commission.

Funds are to be provided by a motor tax of 35 cts. per horse power, half of which goes to the state and half to the county in which it is collected. Commercial motor vehicles are taxed according to carrying capacity, as follows:

Wt. in lb. per wheel	Fee
1,001 to 2,000	$20.00
2,001 " 4,000	40.00
4,001 " 6,000	60.00
6,001 " 8,000	150.00
8,001 " 10,000	300.00

For loads greater than 10,000 lb. per wheel the fee increases at the rate of $500 for each 1,000 lb. increase in weight. No load greater than 800 lb. per in. width of tire, and no vehicle having a total gross weight of over 14 tons, will be permitted in any case.

There are about 200,000 motor cars in Texas and it is estimated that the total tax will amount to about $2,000,000 the first year.

Undergraduate Specialization in Highway Engineering and the Demand for "Highway Engineers"

Highway engineering education has been given much attention during the past few years, both by educators and engineers, and there has been a wide divergence in the views expressed. The annually increasing amount of road work, the rapidly changing traffic conditions and the tendency to popularize some of the strictly engineering phases of road work have focused attention upon the training given by the engineering schools to prospective highway engineers. The result has been an insistence in some quarters upon the establishment of special undergraduate courses in highway engineering. As one reason for such specialization its advocates have claimed that the demand for "highway engineers" exceeds the supply, inferring that graduation from a specialized course such as suggested would qualify a young man as a "highway engineer."

It an effort to ascertain the views of those best qualified to pass judgment on the merits of undergraduate specialization, "Good Roads" recently sent letters of inquiry to the heads of the civil engineering departments of the leading technical schools, universities and colleges of the country asking for their views upon the matter. These inquiries not only requested an expression of opinion "as to the advisability of introducing into undergraduate civil engineering courses any considerable specialization on the subject of highway engineering," but also included an inquiry as to whether or not those addressed had "noted any increase of late years in the demand for civil engineering graduates for positions in road and street work." In explanation of the requests for information the following paragraph was included in the letter:

As you are probably aware there has come from certain quarters statements to the effect that the demand for "highway engineers" exceeds the supply, and with it a suggestion for the establishment of undergraduate courses in highway engineering in technical schools and colleges. Opinion is naturally divided on the subject of highway engineering education. There are many who disagree with the argument that the undergraduate should specialize to any considerable extent, holding that the best preparation for highway engineering is a thorough grounding in civil engineering such as is furnished by the best civil engineering courses. Those who take this position also put forward the argument that the undergraduate seldom has in view any particular work and as a rule enters some particular branch of engineering by chance instead of choice.

While not all of those addressed have replied, letters have been received from some sixty of the principal educational institutions maintaining civil engineering courses. These naturally contain some widely varying opinions and form a most interesting and instructing symposium on the matter covered. The limited space available does not permit the reproduction of all of the letters and for that reason there are printed extracts from only a comparatively few, taking up the two subjects of inquiry separately.

Specialization in Undergraduate Courses

Almost exactly two-thirds of those who replied expressed themselves as opposed to "any considerable specialization" in undergraduate courses, among these being representatives of a large proportion of the engineering schools of the highest standing. About two-thirds of these—or approximately one-half of all those who replied—very strongly opposed undergraduate specialization in highway engineering. One of the most positive statements received came from Dean Robert Fletcher of the Thayer School of Civil Engineering, Dartmouth College. Dean Fletcher returned the letter of inquiry with a marginal notation indorsing the latter part of the paragraph quoted above and also wrote, in part, as follows:

Besides returning yours of March 31st with margin scored, I have to say that we are rather tired of the great noise that is being made in some institutions about establishing special and extensive courses in highway engineering, with laboratories to investigate many points of detail, making model road sections, etc., etc., etc. We believe that the benefits to the students and to the profession are in some degree illusory, and certainly not worth the time and cost.

Extracts from other letters emphatically opposing specialization follow. They are from the following: (1) Dean E. E. Haskell of the College of Civil Engineering, Cornell University; (2) Prof. H. E. McCausland, of the Catholic University of America; (3) Prof. Harry M. Showman, of the Colorado School of Mines; (4) Dean J. H. Dorroh, of the School of Engineering, University of Mississippi; (5) Dean Wm. G. Raymond, of the College of Applied Science, State University of Iowa; (6) Prof. Donald Derickson, of the School of Civil Engineering, Tulane University; (7) Prof. Arthur W. French, of the Department of Civil Engineering, Worcester Polytechnic Institute; (8) Dean E. J. McCaustland, of the School of Engineering, University of Missouri; (9) Prof. C. C. Williams, of the Department of Civil Engineering, University of Kansas; (10) Prof. F. H. Constant, of the John C. Green School of Science, Princeton University; (11) Prof. Chester Allen, of the Department of Civil Engineering, Pennsylvania College; and (12) Dean A. A. Titsworth, of the Department of Civil Engineering, Rutgers College.

(1) My own feeling is that the best highway engineers, in the final accounting, will be those who have had a thorough training as civil engineers. The man with the broad training is the one who can become an investigator, a designer and a constructor, and any engineer who cannot qualify as an investigator, is a poor one for any field of engineering work.

I feel safe in saying that not over 7% of the undergraduates of any engineering college have any idea of the line of work they are going to follow after leaving school. It is a case of making choice in the market of the day after they have their diplomas. If the young man's training has been broad and thorough, he is in a position to qualify, not as an expert, but as an intelligent apprentice in any field of civil engineering.

(2) With regard to the establishment of specialized courses in highway engineering for the undergraduate, I would say that it is my honest conviction that such a step is not justifiable, at least not under present conditions. The average age of the freshman, in engineering as well as other courses, is 18 years, and granting that the first two years would be the same for all engineers, we thus have students at 20 years of age faced with the problem of deciding on just what particular branch of civil engineering they are to spend the two remaining years of study, and, probably, also the rest of their natural lives. They have but a vague knowledge of the many fields covered by the term "civil engineering," and know little or nothing of their adaptability to any one particular field.

The result at this stage in their lives is the uncertainty of choosing wisely and the almost fatal results if the unwise path is selected. Upon graduation the young engineer generally accepts anything that comes along just so it is in engineering, and for the first few years does not do the selecting to any marked degree, finally deciding only after a process of elimination by trial.

(3) It is my belief that specialization of work is not desirable in undergraduate courses; that to give broad training as real engineers, is what the engineering schools should strive for rather than to attempt to compete with trade schools in offering instruction by which students can at once obtain jobs. A student who has had "highway engineering" thrust into a schedule must either do without other subjects more fundamental, or must obtain a scanty knowledge of all. He might be a better highway constructor, but would certainly be a poorer engineer.

(4) In my opinion fundamental work in civil engineering, either technical or more or less cultural, should not be displaced in order that specialized work in highway engineering may be given. I would rather train the students in the basic studies so that they can become engineers in any line.

(5) We carry a course in highway engineering as a part of our regular civil engineering course. We do not specialize in highway engineering at all. We believe that the general divisions of civil, electrical, mechanical, and possibly chemical engineering, are sufficient divisions for an undergraduate course, and we are even contemplating an undergraduate course that will not distinguish in the four years, except possibly chemical engineering, which will be a five-year course anyway.

(6) It is my opinion, based on the experience of nearly twenty years in the active practice as well as the teaching of civil engineering, that there is no room in a four-year undergraduate course for specialization in any real sense of the word. Possibly one course of a few hours per term may be elected to the advantage of the student, not so much for the information derived as the fact that he is at work on some subject that he likes and will study with more interest than one that he is forced to take up. The special fields such as highway, bridge, sanitary and other branches of engineering are so extensive that they would seem to at least require all that is to be had in a good, general course in civil engineering. It is my opinion that a student can not take up a specialty to his advantage until he has had some real experience in the particular field which he proposes to enter. He does not know the important from the less essential. Few, very few, students are fortunate enough to know beforehand the branch of engineering that they will enter and hardly any will be able to tell whether they will find such work to their liking.

(7) It is my belief that in the undergraduate courses in civil engineering the young man who may go into highway work has no time or fitness for specialized work in any branch of the profession. The fundamentals of science and the applications to elementary problems for the purpose of a firm grasp of the principles is my aim in courses in civil engineering at the Institute.

I see no reason for special courses in highways, for about all of the civil engineering course has bearing on the preparation of the man for highway work. In laboratories it might be well to examine some road materials, not for special knowledge, but as any materials are examined, to familiarize the student with methods for testing.

(8) I believe a well arranged course in civil engineering, which emphasizes the fundamental sciences of physics, chemistry, mathematics, mechanics, and the study of materials, is the best preparation for specializing in highway work.. I believe in a fifth, or graduate year, considerable time might be spent on the study of road materials and their manipulation, and road economics as a specific training for the highway engineer.

(9) I am not in favor of introducing a considerable amount of specialization in highway engineering into the undergraduate civil engineering course for the following reasons:

a. Highway building is decidedly in the state of an art at present with relatively few principles peculiar to it fixed with certainty. Due to its being in a formative stage, it cannot be taught in an intensive manner profitably to undergraduates. As yet, it is far from having attained the status of a science comparable with structural, hydraulic, sanitary, or railroad engineering.

b. Highway engineering does not involve many new fundamental principles that are not already considered in courses now offered, viz., surveying, railroad location, chemistry, mechanics, hydraulics, etc., and the brief course that is customarily given in the civil engineering curriculum is sufficient to treat briefly such new concepts as are encountered and to correlate those from the other subjects involved.

c. A man who has pursued a well balanced course in civil engineering as it is offered in colleges of recognized standing has a better perspective, a more evenly balanced judgment and a more adequate sense of proportion with regard to construction matters than one who has followed a highly specialized course even under most favorable conditions, and in its present state, highway engineering needs this sort of ability more than premature technical specialization.

d. The time available for undergraduate study is scarcely sufficient for the fundamentals without extended specialization in any subject, and the fundamentals of mechanics, materials, etc. are the most valuable.

e. My observation of graduates from highly specialized courses is that, on the average, they are at a serious disadvantage because only a small percentage actually drift into their specialties.

(10) We do not believe, at Princeton, in the introduction of any highly specialized work into undergraduate courses. We believe that the first four years should be devoted wholly to the fundamental principles of engineering in as broad a way as possible. The place for specialization is in the fifth or higher years, and we are planning at Princeton to introduce such graduate work. If this plan is carried out we shall doubtless make provisions for higher work in highway engineering.

(11) I do not believe in too extreme specialization in undergraduate courses. The student has made one specialization when he chose engineering instead of some other course, and made a still further specialization when he chose civil engineering instead of some other branch. To have him still further specialize would, in my opinion, be carrying the thing too far. Also, as you have noted in your letter, specialization in an undergraduate is rather apt to be a matter of chance than of deliberate reflection. I would be in favor of the regular course of about 30 recitations, with possibly some laboratory work in addition, but that is as far as I would go in an undergraduate course.

(12) In general, I do not favor specialization in undergraduate studies in civil engineering along any line, except to emphasize principles and teach general methods. A year of practical work after graduation will do more for the young engineer in teaching him practical methods than could possibly be drilled into him in the few hours that could be devoted to that particular phase of his education; besides he would not have to "unlearn" so much that had been taught him. Specialization in undergraduate studies to any considerable degree is too narrowing an educational process.

There are essential principles common to all engineering activities which, it seems to me, must be taught to each civil engineering student, which he will never assimilate into his mind unless it is by this undergraduate educational process, in order to fit him to take a high place in the profession, and there is not sufficient time given to undergraduate study to cover these essentials and do more than elementary specialization in the last two years of his course. I favor a fifth year for specialization, and that, preferably, after a year or more of practical work. After that experience he is likely to change his mind and want to go into some other line.

All this applies to specialization in highway engineering in particular, in my opinion.

Typical of the letters less emphatically opposing specialization but still not favoring any considerable departure from regular courses are the following extracts from letters from (1) Prof. T. W. Dix, of the University of Vermont; (2) Prof. E. B. House, of the Department of Civil and Irrigation Engineering, Colorado State Agricultural College; (3) Prof. L. E. Conrad, of the Department of Civil and Highway Engineering, Kansas State Agricultural College; (4) Prof. C. J. Tilden, of the Department of Engineering, Johns Hopkins University; (5) Prof. Hector J. Hughes, of the School of Engineering, Harvard University; and (6) Prof. J. L. Van Ornum, of the Department of Civil Engineering, Washington University.

(1) I would be in favor of enlarging somewhat upon the work in highway engineering as taught in most colleges at this time, in so far as this could be accomplished without interfering with the teaching of fundamentals.

(2) We have been teaching road construction at this institution for some twelve or fifteen years, and we have taught it as a part of our civil engineering course. The fact of the matter is, that all the surveying work in road construction is taught in the ordinary civil engineering course, and then we give a course in road construction which takes up the principal phases of laying out roads, fundamental principles of pavement and surfacing materials for roads, the proper survey and the problems that present themselves in road construction. This, together with our work in strength of materials, drainage, surveying, trusses and bridges, etc., makes in my judgment a course in road construction such that any ordinary man having had this work at the college can take up the practical work of road building, and with a little practical experience will be efficient at this work. I cannot see why it would be necessary at this institution to install a separate course of four years in road construction. Of course, if this were done we would do somewhat more along the technical side of roads and go into the subject of pavements much more thoroughly, but as most of our road construction in the West must necessarily be the ordinary dirt road, or at best the dirt road with a gravel surface, I do not see the need at the present time of a separate course in road construction for engineers in this section of the country.

I notice what you say about a young man upon graduation not knowing exactly what line of work he will follow, and I fully appreciate this point of view. I agree with it in every way and I know that it is more a matter of chance than anything else which governs the special line of work that a graduate will follow.

(3) I believe that it is inadvisable to attempt any considerable amount of specialization in a four-year course in civil engineering. After considerable thought devoted to the question of additional work in highway engineering, we have decided that we can best meet the situation by giving an introductory course, consisting of two recitations or lectures per week, together with three hours per week in testing road materials, for one semester, to all civil engineering students. In addition, we are offering an optional course in highway engineering in the second semester of the senior year. This more advanced course is to consist of two recitations per week and six hours per week devoted to field and office work. The field and office work will consist of a survey for a new highway or the improvement of an existing road, together with the design of structures, preparation of estimates, etc.

(4) I am one of those who do not, in general, believe that there should be any great degree of specialization in the undergraduate years. It takes pretty much all of the four years in college for a boy to learn what he should know of physics, chemistry, geology, mathematics, English, and so on, to say nothing of the training that he must have in drawing, applied mechanics, strength of materials and the elements of designing. Our course in engineering here at the Hopkins is rather broader than in most colleges, for we do not permit specialization even in the main branches of civil, mechanical and electrical engineering until the student has completed his third year. In the fourth year, there is a division of the students into the three main groups, and that year they devote practically their whole time to the special department that they have chosen. The field of civil engineering, however, is such a broad one that it is not possible in one year to specialize to any very great extent within that particular field. The work that is offered, therefore, in highway engineering, of necessity has to be rather limited.

I do, however, urge the students to take an additional year or two, if they can afford it, before going into active professional work. It is in that subsequent course that I believe a high degree of specialization can be effectively attempted along the lines of highway engineering, as one of several possible major subjects. I do offer a course in which the elements of highway engineering are touched upon, which is open to election by seniors in the undergraduate department, but this is hardly more than a foundation upon which to build further work in the graduate years.

(5) I am aware that from certain sources statements have come that the demand for highway engineers exceeds the supply. I have several times made such statements myself, and I believe it is true. On the other hand I do not think this implies that specialized undergraduate courses in highway engineering should be provided for undergraduates.

I think it is entirely feasible to provide options not only in highway engineering but in other specialized fields, which will enable students to get a start in one of these fields while they are at the same time getting a good training in civil engineering.

It seems to me that the one essential thing for all civil engineering students is that they should have a thorough grouding in civil engineering; and anything which interferes with that is not, in my opinion, desirable.

(6) With regard to your question as to the desirability of having courses on such subjects in the curricula of engineering schools, I may state that I am thoroughly in sympathy with the idea that the prescribed engineering courses should be especially concerned with the thorough and broad training in the fundamental principles of engineering. Nevertheless, it seems to me that this primary requisite in no way excludes post-graduate courses in highway engineering, or elective courses in that subject in the senior year. On the contrary, I believe that opportunity for such study should be offered in one or both of the ways just mentioned.

Considerable attention was paid to this subject at a meeting of Section D, Engineering, of the American Association for the Advancement of Science held at New York, N. Y., in December of last year. One of the papers was presented by T. R. Agg, Professor of Highway Engineering at the Iowa State College. ["The Need for Highway Engineering Courses in Civil Engineering Curricula of Western Colleges," "Good Roads," Jan. 20, 1917, p. 34.] In his reply to the letter of inquiry Prof. Agg refers to this paper as expressing his views in detail and adds:

I do believe that men who have, during their college career, had their attention directed to the more technical phase of highway engineering will do better work and will advance more rapidly than the men who have graduated from a straight civil engineering course. On the other hand, I do not feel that it would be advisable to urge young men to specialize in highway engineering to the exclusion of any of the fundamental subjects usually included in our established civil engineering course.

One of the letters most strongly advocating undergraduate specialization was written by R. P. Black, University Engineer of the University of the South. A part of the letter follows:

I am a strong advocate of all colleges and universities that have scientific courses giving a detailed course on highway construction. Under my instruction I have instituted here a course in highway engineering and at present writing am to start this course shortly for the first time and am of the opinion that it can be sufficiently covered in a three-month course to advanced engineering students to give them a good start to become highway engineers, and to start them on further special study to become properly equipped.

Another letter favoring specialization was writtten by Prof. R. W. Thoroughgood, of the College of Engineering, University of Florida. This letter is, in part, as follows:

I have no hesitancy in saying that were it true that the demand for highway engineers exceeds the supply—which I doubt from experience—there would be ample justification for a short undergraduate course, specializing on highway work to fill up the gap. Several fields of endeavor are closed to our graduates here because of the lack of certain types of industry in the South, but we are certain to do much highway building and it is likely to prove a considerable outlet for our future engineering graduates.

As to specialization of civil engineering work in the direction of highway engineering, much can be done to advantage. Most all of the courses given in civil engineering are useful and some vital to the highway engineer, but I believe it is idle to say that the regulation course in civil engineering with only a smattering of highway work—leaving the rest to be acquired later by study and experience—is just as good for the future highway engineer as a course in civil engineering in which specialization in highway work is carried on in the last year at least, in both laboratory and class room, with stress upon the laboratory work.

Benefit might easily accrue to the student in engineering, if there was less of science and more of business and economics introduced into the course. For the highway engineer much would be gained by the introduction of courses in taxation, bonding, city management, county and state organization, organization of highway departments, and contracts covering both materials and labor as well as courses having to do with accounting and record keeping.

Prof. R. L. Morrison, of the School of Engineering, Agricultural and Mechanical College of Texas, presents very fully from one angle, the views of those favoring specialization. An extract from his letter follows:

I fully agree with those who argue against specialization in undergraduate work and consider all of the objections valid. However, I do not think that the general rule applies as much to highway engineering as it does to other branches, because the supply of properly trained highway engineers is certainly less than the demand. There are plenty of applicants for every job, but at least in this part of the country, there is a very small per cent. of the applicants for the highway engineering positions who have any extensive training or experience in road building, or at least in building any types other than gravel roads.

The college graduate who takes up railway work, structural work, or almost any other branch except highway engineering, goes to work under the direction of engineers who are thoroughly trained in that line, but in many cases the recent graduate who goes into highway work has no one at all over him or works under the direction of a man who knows little more about highway engineering than the recent graduate himself.

Another reason why I consider specialization in highway engineering does not come under the general rule is that it is practically impossible for an engineer to "pick up" anything more than a most superficial knowledge of bituminous materials unless he has a pretty thorough course in college. I doubt if 5% of the highway engineers could write specifications for bituminous materials and know the reason for every item in the specification. This may not be true, and I hope that it is not, but I have seen specifications from one or two of our larger cities, where the whole specification for bituminous binder was "the bituminous binder shall be ——— asphalt or equal."

Believing that there was a scarcity of properly trained highway engineers in Texas, and that it was difficult for most of the graduates to receive a very scientific training along that line after graduation, this college established an undergraduate course in highway engineering as an option in civil engineering, the two courses being the same until the senior year, when approximately one-third of the student's time is occupied in the study of the various phases of highway engineering. This course has been in effect for seniors for two years, and each year approximately one-half of the senior class elected the highway engineering option.

Letters from a number of others who favor what might correctly be termed "considerable" specialization in undergraduate courses are presented, in part, herewith. The writers are as follows: (1) Dean C. N. Little, of the College of Engineering, University of Idaho; (2) Director James I. Tucker, of the School of Civil Engineering, University of Oklahoma; (3) Prof. A. E. Winslow, of Norwich University; (4) Prof. Leonard S. Smith, of the College of Mechanics and Engineering, University of Wisconsin; (5) Dean Geo. Jacob Davis, Jr., of the College of Engineering, University of Alabama; and (6) Prof. F. H. Newell, of the Civil Engineering Department, University of Illinois.

(1) In preparing the program of studies for the civil engineering students next year, we have changed the course in highway engineering from two credits, one semester, to three credits, thus recognizing the increasing importance of specialized highway instruction. The division of the student's time between fundamental engineering training and specialized courses in the different fields of engineering is a difficult matter. I am very fully persuaded, however, that the important work of an engineering college is in stressing the fundamental courses. Where applied courses are taught at all, we try to have them conform to the best practice in the outside world, and in some degree to correspond to the probable openings before our students. For this reason we are now diminshing the time given to railroads and increasing that put upon highways.

(2) We are firmly of the conviction that a certain amount of specialization is desirable and are now offering an additional four term-hours work in highway engineering, as an option to the same amount of time in railroad work, leaving it required that each man takes four hours of highway work and four hours of railroad, with the option of increasing either to eight. The writer is of the opinion that this is a reasonable and practicable plan for most states other than the eastern and New England states.

(3) I think there has been a noticeable demand for graduates to take up highway work, and as a result we have established additional specialized studies in highway engineering.

I believe that the same general engineering and cultural subjects should be taught to all engineering students for the first three years and then give them an opportunity to branch out into their chosen special lines of study. There is great danger in going too far with this undergraduate specialization; let him have a taste of the real life that he may determine his place in the great game.

(4) In my opinion, it is desirable to introduce at least an introductory course in highway engineering for all civil engineering students—this has recently been done at the University of Wisconsin. In addition a highway engineering option is provided, giving instruction in three or four additional courses including laboratory practice in the testing of mineral as well as bituminous material. * * *

There has been a large increase in the number of applications for students in highway engineering especially from highway commissions. At the present time I have applications for over half of the members of the senior class in this line of work. The supply of engineers is far from being sufficient for the demand. If properly taught, the teaching of highway engineering gives opportunity for driving home many valuable general principles which should govern any type of engineering construction.

(5) We have found it advisable to introduce into our undergraduate civil engineering course a considerable amount of matter relating to highway engineering. We are also offering advanced courses in highway construction for those who wish to specialize in this line of work. I do not favor having separate courses in highway engineering leading to a degree in that subject. I favor rather modifying the regular civil engineering courses in such a way as to make all the graduates in that department qualified to enter into highway construction.

(6) In your letter of March 31 you have asked for a brief statement as to the advisability of introducing into undergraduate civil engineering courses any considerable specialization on the subject of highway engineering. This has already been done at the University of Illinois, and about one-third of the senior students in civil engineering are devoting a considerable part of their time to details of highway work.

The Demand for "Highway Engineers"

Among the replies to the inquiry relative to the demand for men for road and street work there was all the variation that might have been expected. For the purpose of inviting fuller discussion of the subject the query was not so worded as to encourage a brief "yes" or "no" in reply, and for that reason it is not possible to tabulate the replies in that way. Some of them take up the question as to whether or not an increased demand has been noted during the past few years and some refer only to the relation between supply and demand.

Of 34 replies to the first question, 17 may be construed as affirmative and 7 as negative, while the remaining 10 report on the present demand without stating whether or not an increase has been noted.

The geographical distribution of the affirmative replies, by states, is as follows: California 1, Florida 1, Illinois 1, Indiana 1, Iowa 1, Massachusetts 1, Minnesota 1, Mississippi 1, Missouri 1, New Jersey 1, Pennsylvania 2, South Dakota 1, Tennessee 1, Vermont 1, Virginia 1, Wisconsin 1.

In some instances the increased demand noted is ascribed to local conditions. Prof. Charles G. Hyde of the University of California, for instance, reports that: "On account of the immense amount of highway work which has recently been undertaken in this state, particularly by our California State Highway Commission, we have noted during the past four years a very decided increase in the demand for engineering graudates to undertake such work." Prof. F. H. Newell of the University of Illinois states that there is "a steadily increasing demand for young men in connection with the work being carried on by the state and by county authorities," and Dean Wm. G. Raymond of the College of Applied Science, State University of Iowa, reports that: "There has been an increase in this state in the demand for highway engineers, owing to a new highway law." A growing demand "for college men in highway engineering in New Jersey and New York particularly" is reported by Prof. A. A. Titsworth, Dean of Engineering at Rutgers College, and the "increased use of the automobile and the awakening of the South by federal aid to road building" are cited by Prof. Chester Allen of Pennsylvania College as the causes of an increased demand.

In some cases the statement that an increased demand has been noted is qualified to some extent. Prof. George E. Martin of Purdue University, for example, reports "some increase" in the demand for students in highway positions, but adds: "However, many of these positions are temporary in character since they extend only through the construction season."

Prof. J. M. Brauen of the Universtiy of South Dakota writes as follows:

"There has been some increase in the demand for civil engineering graduates for positions along the line of highway engineering, or, I might better say, more of the graduates are choosing that field."

A statement from Prof. N. W. Dougherty of the University of Tennesee follows:

"I think there has been a marked increase in the demand for trained highway engineers in the last few years. I have no figures to show that this is actually true, but I cannot see how so much new work can be done without such a demand. It is certainly true that the country is becoming more and more interested in the construction and maintenance of roads that may be classed as improved surfaces."

Another phase of the situation is touched upon in a letter from Dean D. C. Humphreys of the School of Applied Science, Washington and Lee University. Dean Humphreys writes:

"I have noticed a great increase in the demand for engineers in highway work. Salaries are small—not so much the beginner's salary, but the pay of the men high up is so small that most of our graduates are not attracted to highway engineering as a career."

The seven replies classed as negatives were received from instiutions in the states of Colorado, Illinois, Kansas, Massachusetts, Pennsylvania, Rhode Island and Washington. These letters may be divided into two classes, one reporting no increases in the demand and the other reporting no demand. There are four of the former and three of the latter. The writer of one of the former, who does not wish his identity revealed, adds:

"When the state highway departments adopt the policy of many of our corporations of going after the engineering graduate with a view of getting the best available material for their purposes, we may see a different condition of affairs."

Dean Almon H. Fuller of the College of Engineering, University of Washington, writes as follows:

"We have noted no recent increase in the demand for men especially trained in highway work, except a temporary demand for about six months in the year. Desirable permanent positions in this part of the country are apparently very few.

"The greatest need in highway engineering, as I see it, is to get the state and county work out of politics and to form an organization that can be kept intact not only throughout the year but over a term of years."

Practically all of the ten letters reporting on the present demand but not comparing it with that in the past are to the effect that there is a demand for graduates to go into highway work.

Of the 18 letters taking up the question of the relation between the supply and demand, 8 express the belief that the demand exceeds the supply, 5 that the demand does not exceed the supply and 5 express doubt as to the relation or fail to express a positive opinion. One of the 8 affirmative replies brings out a point worthy of careful note. The letter is from E. J. McCaustland, Dean of the School of Engineering at the University of Missouri, and is, in part, as follows:

"I believe it is true that the demand for thoroughly trained and experienced highway engineers exceeds the supply, but on the other hand, I believe the schools are already providing the training; the experience must come through practical work and, of course, that necessitates considerable time."

Several of the letters answering the question in the negative contain statements of considerable interest. For instance, Dean J. H. Dorroh of the School of Engineering, University of Mississippi, writes as follows:

"It is true that the need for trained men in highway engineering enormously exceeds the supply; the need still more, perhaps, exceeds the demand."

Prof. Donald Derickson of the School of Civil Engineering, Tulane University, expresses his opinion as follows:

"I have not noted from my own experience or from personal observation that the demand for highway engineers exceeds the supply. There are many mediocre men, graduates of schools where high requirements are not rigidly enforced, that will gladly serve as highway engineers at such salaries as they can get. If a high grade man is wanted—and he is to be paid a fair compensation for his specialized knowledge, executive ability and responsibility—it is my opinion that he can be secured."

Prof. J. M. Brauen of the University of South Dakota writes as follows:

"I cannot agree with the statement often expressed that the demand for capable men in this line far exceeds the supply. Such statements sometimes come from misinformed individuals who wish to secure high grade technical ability for a very low figure; and when they either fail to secure the type of engineer wanted, or are disappointed because some poor under-paid individual with no props in the way of help and cooperation from his employers, does not give the service they think he should, after their kind they howl long and loud."

One of the letters not expressing a definite opinion as to the relation between demand and supply is from Prof. Alfred E. Phillips of the Department of Civil Engineering at the Armour Institute of Technology. It is, in part, as follows:

"The demand for 'highway engineers' may exceed the supply, but in my opinion, if such a condition exists it is because the compensation offered in this line of work is not such as to attract trained men. There is little or no chance for advancement and usually the engagement is too temporary to appeal to the average engineer."

Road Building Materials in Alabama

It is reported that the United States Government, looking toward the possible building of military highways, is desirous of securing information as to the available road building materials of Alabama. The State Geologist who will compile data on the subject will be able, it is stated, to submit a report on July 1.

Proposed Improvement of Motor Route to Atlantic City, New Jersey

At a recent conference between state highways officials of New Jersey and residents of Atlantic City, held at Trenton, the question of improving the White Horse Pike between Camden and Absecon, the automobile route from Philadelphia to Atlantic City, was discussed. No definite action was taken, but the matter is to come up for hearing by the State Highway Commission on June 15.

The commission has approved contracts for construction work on the Delaware River Road in Mercer County, the New Egypt-Cookstown Road in Ocean County, the Malaga-Pennsgrove Road in Salem County, the Moorestown-Camden Pike, in Burlington County, and the improvement of the inter-county bridge over the Manasquan River.

Highway Department Proposed for Nassau County, New York

A department of highways to supplant the present office of county superintendent has been proposed for Nassau County, L. I., by the Nassau County Association, at an expense of approximately $25,000 a year.

The proposal contemplates the employment of a chief engineer at a salary of $4,500 a year, an assistant engineer at $3,000, a construction engineer at $1,800, and a maintenance engineer at $1,800 a year. Estimates of other salaries and expense are placed at the following amounts: Temporary inspectors, $6,000; office clerk, $1,200; draftsman, $1,000; bookkeeper, $900; stenographer, $900; office rent, $1,500; operating expenses, $500; surveying equipment (first year), $2,500; supplies, $500; incidentals, $1,500.

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Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

MAY 19, 1917.

SCHOLASTIC TRAINING FOR ROAD WORK AND THE DEMAND FOR HIGHWAY ENGINEERS

The subject of highway engineering education is discussed at considerable length on other pages of this issue by means of extracts from letters written by educators engaged in work along that line. It is a subject that is always of interest and importance and one to which we have directed attention several times previously in this column. The discussion printed elsewhere is commended to the especial attention of our readers because it brings together conclusions drawn from observations made in every part of the country, and covering, in many instances, the experience of years.

The competency of the witnesses in this case is beyond question. In almost every instance the letters quoted were written by the heads of civil engineering departments in the foremost technical schools and colleges of the country. Many of these men are themselves practicing engineers of high standing, and, as a class, they are in the best of positions to pass judgment on this particular matter. It is safe to assume that the majority of them are in rather close touch with the graduates of the various institutions they represent and they know very closely how well the curricula of their several institutions have been adapted to the needs of the students after graduation.

Over four years ago we noted in these columns the advocacy of specialized undergraduate courses for training "highway engineers" and the alleged lack of men properly trained to undertake highway work. ["Education and Training for Highway Engineers," "Good Roads," Dec. 7, 1912, page 258.] At that time we took the position that specialization in undergraduate courses in civil engineering was undesirable and that the apparent lack of men properly trained to direct highway work was due not to a real scarcity of competent men but to the failure of the field to attract men of the requisite training and of the proper caliber.

We have held to the same position and from time to time have argued against the continued insistence from some quarters upon the establishment of highly specialized undergraduate courses to train men for highway work.

The first essential to a rational discussion of the proper training for highway engineering work is a clear understanding of the function of the technical school. And the first fact to recognize is that the technical school is not designed to, and cannot, turn out engineers. The ordinary four-year engineering course can be expected to do no more than give the student a knowledge of the fundamentals of pure and applied science and inculcate in him certain mental qualities and habits that he will require after graduation. In other words, it should not be expected to make him an expert in the construction of roads or bridges but rather to teach him the use of the tools and give him the foundation of theoretical knowledge he will need in his future work. There are certain fundamental subjects such as mathematics, physics and chemistry that are essential to the practice of any branch of engineering. There are so many of these and so much of each is required that in the ordinary four-year course there is no room for anything else. All of these bear more or less directly upon road building and upon every other branch of civil engineering, and to displace any one of them by studies relating solely or almost entirely to some particular branch of engineering takes just so much time from the study of the fundamental subjects so necessary for all engineering work.

This view is adequately supported by the evidence collected. The majority of those who express opinions are opposed to any considerable amount of specialization, and among those who take the opposite side very few advocate an entirely separate course in highway engineering, favoring rather the plan of offering numerous electives in the latter part of the college course.

The replies to the second question covering the demand for engineering graduates in highway work indicate a strong and growing demand, and the geographical distribution of the replies indicates that this is general throughout the country and not local. The reports also support the reasons we have previously advanced for the apparent lack of trained road builders, chief among these being the inadequate compensation and the insecurity of tenure of office in highway work.

The evidence as to the relation between the demand and supply of highway engineers is not so conclusive. The reason for this can perhaps be found in the statement made by one of the writers to the effect that while the need for trained men in highway engineering exceeds the supply the need still more, perhaps, exceeds the demand. Any one familiar with the manner in which road work is conducted in all too many localities will unhesitatingly grant the existence of a very great need for highway engineers. But it does not follow that where the need is great the demand is great, for we have not yet progressed sufficiently to realize—and act upon—the desirability of placing public work in charge of those best qualified to carry it out. If that practice were universally followed there is little doubt that the demand would exceed the present supply. On the other hand, if at the same time adequate remuneration were provided and the tenure of office made dependent less upon political considerations and more upon ability, there is no doubt that a supply equal to the demand would be forthcoming.

Another point which bears upon this phase of the question is that the demand for highway engineers cannot be judged by the demand for engineering graduates in highway work. The graduate from an engineering course is in no sense of the word a highway engineer or any other kind of engineer. He is merely a man who has had such training that he is in a position to become a highway engineer after a reasonable amount of experience in actual work.

Queens Boulevard, New York City, To Be Improved

Plans for the improvement of Queens Boulevard, in Queens Borough, Long Island, call for the regulating and grading of the thoroughfare, which is the most important one in that borough, from Diagonal Street to Gosman Avenue, on the northerly end of the boulevard, and the laying of sidewalk thereon. The work covers 18 blocks. The lowest bid received was $36,037. In accordance with plans now in preparation by the Bureau of Subsurface Structures, all service lines will be placed beneath the surface of the ground.

Funds for New York State Highway Work

The state funds available for state highway work in New York State in 1917 will consist chiefly of $6,000,000 in addition to a considerable unexpended balance from the 1916 appropriation, according to a recent report. Of the $6,000,000, the sum of $4,000,000 was appropriated for the maintenance and repair of state highways and $2,000,000 for the maintenance and repair of town highways. The construction work done will be paid for from the unexpended balance of the $10,000,000 appropriated for 1916.

According to reports, the department's efforts this year will be directed principally to putting the state road system into good condition, largely with a view to its possible use for military purposes. As part of this plan it is proposed to give especial attention to the road between Albany and New York City. An emergency appropriation of $100,000 was made for this work by the legislature. It is expected that the road will be used extensively for transporting supplies for the military establishments during the summer.

Oiling Earth Roads*

The economy of oiling earth roads is a subject in regard to which there is a great difference of opinion among engineers who have done a large amount of such work. In some places where good results have been obtained it is strongly recommended, while in other places, where it has not proved satisfactory, it is condemned as a waste of money. This may be accounted for by the fact that the kind of soil, the climatic conditions, the amount and kind of traffic, the provisions for drainage, the kind of oil used and the methods of doing the work greatly affect the results. A sticky clay road, a poorly drained road, or a road subjected to heavy traffic, or heavy loads, cannot be successfully oiled. A road of sandy soil, well drained, can often be improved by oiling, especially where there is little freezing and thawing. The oil suppresses the dust and tends to make the road surface waterproof. If a road is smooth, well drained and comparatively waterproof, then water will not stand upon it and it will not cut up under traffic and become muddy. This is the object of oiling.

Before the oil is applied the road must be carefully graded and shaped up, and the dust must be removed as completely as possible. If the road is covered with dust the oil will simply mix with this surface dust and make a disagreeable mess. It is usually best to apply the oil as soon as the road has become dry after a rain and when it has been made smooth with a drag. This reduces to a minimum the problem of dust removal. The road should be dry to a depth of at least 2 in. The oil should be applied as described under the treatment of gravel roads, and for the first treatment about ½ gal. to the sq. yd. should be used. For subsequent treatments, ¼ to ⅓ gal. per sq. yd. is usually sufficient. Care should be taken not to use too much oil, as it makes a disagreeable surface. The oil should be applied as uniformly as possible. After applying the oil, it is well to cover it with a light coating of sand, using 20 to 30 lb. per sq. yd. This gives a better and more durable surface and keeps the oil from "picking up."

During the first year or two it is best to apply the oil both in the spring and in the fall, but after that one treatment a year may be sufficient.

The cost of oiling depends largely upon the amount of preliminary work required in the way of grading and drainage, also upon the cost of oil, the length of haul, etc. After the road has been put in shape the oiling usually costs from $150 to $500 per mi. for each treatment.

Macadam Road to Cost $160,000

A macadam highway, about 30 mi. in length, is being planned for Road Improvement District No. 1, in Scott County, Arkansas, which was recently created by an order of the court. The highway district extends from Waldron to the Oklahoma state line, a distance of 20 mi., and northward from Hon, 9 mi. to the Sebastian County line. A bond issue of $100,000 has been authorized to meet a portion of the cost of the road, estimated at $160,000.

Federal Aid for Minnesota Counties

Under the new road law of Minnesota, a division has been made of the federal aid fund of $1,613,500, minus 10% for administration expenses and $20,000 for the reserve maintenance fund, and the counties of the state will receive the following allotments:

Chisago and Pine, each $40,000; Hennepin, Ramsey and St. Louis, each $30,000; Beltrami, Blue Earth, Dakota, Itasca, Otter Tail and Stearns, each $20,000; Sherburne, $19,500; Cass, Polk and Winona, each $19,000; Goodhue, $18,500; Aitkin, $18,000; Carlton, Olmsted and Renville, each $17,000; Mower, Redwood and Washington, each $16,500; Le Sueur, $16,325; Becker, Brown, Faribault, Fillmore, Jackson, Martin, Morrison and Rice, each $16,000; Anoka, Cook, Freeborn, Lyon and Nobles, each $15,500; Benton, $15,075; Carver, Crow Wing, Marshall, Murray and Steele, each $15,000; Yellow Medicine, $14,750; Lake and McLeod, each $14,500; 40 remaining counties, each $14,325.

NEWS NOTES

Miami Street in Toledo, Ohio, is to be paved between the city line and Fassett St. with vitrified brick, at a cost of $71,000. Harris & Tansey are the contractors.

The People of Harris County, Texas, will decide the question of a bond issue of $1,100,000 for county road construction at an election which has been called for June 27.

The Widening of Madison Ave., Peoria, Ill., for a distance of 10 ft. on either side, from Fulton St. to Main St., is proposed in order to relieve traffic congestion due to a lack of parking space.

A New Thoroughfare Connecting Evergeen, Long Island, with the Manhattan and Long Island City sections of Greater New York is under consideration by President Connolly of Queens Borough.

Automobile Accidents in the State of Iowa during the period from June to December, 1916, in which no fatalities occurred, numbered 2,574. In these, however, 2,834 people were injured. The accidents are said to have resulted from too great a speed for the condition of the roads and the traffic thereon, and it is further stated that motor cars were responsible for 90% of all accidents on the roads. In 1916 the fatalities on the highways numbered 199.

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*From "Maintenance of Earth, Sand-Clay and Gravel Roads." By R. L. Morrison, Professor of Highway Engineering, Agricultural and Mechanical College of Texas, Bulletin of the A. and M. College of Texas, Vol. 3, No. 6.

New York State Highway Work to Be Let

Bids on a large amount of road work have been asked by the New York State Highway Commission for May 28, 1 p. m. The work is located in various counties, as follows:

Albany County: Selkirk-Coeymans Road, No. 508, 1.95 mi., cement concrete pavement reconstruction, estimated cost $32,100.60; Delaware Road (Part 4), No. 198, and Wolf Hill-Berne Road, No. 566, 3.31 mi., 3-in. bituminous macadam resurfacing, $41,958.38.

Cayuga County: Cato-Meridian-Baldwinsville Road (Part 1), No. 684, 1.18 mi., 2½-in. bituminous macadam resurfacing, $11,437.

Columbia County: Hudson-Stockport Road, No. 341, and Stottville Road, No. 649, 2.70 mi., cement concrete pavement reconstruction, $45,136.70; Claverack-Chatham Road (Part 2), No. 1332, 7.77 mi., bituminous macadam construction, $79,811.51.

Essex County: Port Henry-Westport Road (Part 2), No. 744, 3.77 mi., 3-in. bituminous macadam resurfacing, $24,984.66.

Greene County: Hunter-Windham Road (Part 2), No. 797, and No. 998, 9.68 mi., bituminous material surface treatment, $17,287.66; Athens-Coxsackie Road, No. 5368, 3.92 mi., cement concrete pavement reconstruction, $62,478.

Herkimer County: Herkimer-Middleville Road, No. 460; Middleville-Poland Road, No. 461; Manheim Ctr.-Salisbury Ctr., No. 463; Salisbury Center-Burrells Road, No. 465; Burrells-Middleville Road, No. 466; Richfield Springs-Warren-Springfield Road, No. 471-830; Ilion-Cedarville Road, No. 5466, and Jordanville-Richfield Springs Road, No. 5524, 42.49 mi., tar surface treatment, $18,756.10.

Jefferson County: Henderson Harbor Road, No. 238, 3 mi., 2½-in. bituminous macadam resurfacing and widening 4 ft., $27,593.70; Philadelphia Village Road, No. 1484, 0.66 mi. bituminous macadam construction, $12,475.30.

Niagara County: North Tonawanda-Sanborn Road (Parts 1 and 2), No. 643, 3.12 mi. 3-in. bituminous macadam resurfacing, $31,137.50.

Ontario County: Holcomb-Canandaigua Road, No. 5576, 4.69 mi., 3-in. bituminous macadam puddled resurfacing, $41,106.25.

Orleans County: Maple Ridge Road (Part 2), No. 390. 2.80 mi., 2½-in. bituminous macadam resurfacing, $15,785.

Otsego County: Morris-Gilbertsville Road (Part 2), No. 678, .90 mi., cement concrete pavement reconstruction, $15,908.75.

Rensselaer County: DeFreestville-Couse Road, No. 981, and DeFreestville-South Road, No. 5196, 2.34 mi., bituminous material, heavy surface treatment, $19,060.50.

Saratoga County: Stillwater-Schuylerville Road (Part 1), No. 5205, 3.12 mi., 2½-in. and 3-in. bituminous macadam resurfacing, $34,180.50.

Seneca County: Ovid-Romulus Road, No. 5282, .81 mi., 2-in. amiesite resurfacing, $7,820.50.

Suffolk County: Coram-Patchogue Road, No. 1018, 2.29 mi., bituminous material surface treatment, $11,523.95; Huntington-Amityville Road (Part 1), No. 794, 2.95 mi., 2-in. bituminous macadam resurfacing and cement concrete pavement, $36,508.70.

Ulster County: Post Road (Part 1), No. 231, and Old Post Road, No. 310, .72 mi., 3-in. bituminous macadam resurfacing, $11,387.50.

Washington County: Greenwich-Battenville Road, No. 724, 3.98 mi., 2-in. bituminous macadam resurfacing, $20,491.25; Fort Edward-Sandy Hill Road, No. 85; Sandy Hill-Adamsville Road, No. 720; Dunham Basin Road, No. 720-A; Hudson Falls Village Road, No. 1080; Comstock-Fort Ann Road, No. 1224, 8.94 mi., oil, tar, surface treatment, $3,559.40.

Westchester County: Ardsley-Elmsford Road (Part 2), No. 34; Unionville-McKeel's Corners Road, No. 52; McKeel's Corners-Briarcliffe Manor Road, No. 53, 7.22 mi., cement concrete pavement reconstruction, $116,956.50.

Bids on Pennsylvania Road Work Rejected

The Pennsylvania State Highway Department rejected all bids opened May 3 on road work in Allegheny, Cambria, Dauphin and Washington counties, noted in "Good Roads" for May 12.

The work, as outlined in the issue of April 21, is being readvertised. The prices bid were deemed excessively high by the department even in view of the scarcity of labor and increased cost of materials.

Road Construction in Cook County, Illinois

Bids for the construction of 8 mi. of the Dundee Road in Cook County, Illinois, were recently received by the County Board. The lowest bid for the east section of the road was that of Joseph P. Casey & Co., $70,946.01. For the west section of the road, Andrew Ward & Sons, of Chicago, submitted the low bid of $94,399.33.

The Higgins Road, commencing at a point 6 mi. east of city limits and ending at the county line, a distance of 18½ mi., is also to be improved. A contract for the work has been awarded to the Commonwealth Improvement Co., of Chicago, at $448,000.

NEWS NOTES

The Van Alstyne Road District of Grayson County, Texas, is considering an election to vote on the issuance of road bonds in the sum of $140,000.

The Hanover Street Bridge, connecting Baltimore City with Anne Arundel County, is nearing completion, and it is expected will be opened to traffic not later than June 1.

The City Commission of Dayton, Ohio, has been authorized to issue bonds to the extent of $473,000 to pay its share of proposed street paving and other improvements.

Road Building in Rhode Island during 1917 will include the state highway from Sugar Loaf Hill to the Matunuck Road, a distance of about 3⅛ mi., the type of construction to be bituminous concrete.

The Police Jury of St. John Parish, Louisiana, has decided to hold an election early in June for the purpose of voting on a large bond issue for building roads in the parish. The amount of the proposed bonds is $180,000.

The Legislature of Idaho recently passed a law appropriating the sum of $20,000 for building a wagon bridge of the suspension type across the Snake River at a point about 2 mi. north of the Town of Hansen, Twin Falls County.

Governor Whitman of New York has signed a bill authorizing the expenditure of $1,980,000 for the paving of town highways, $20,000 for paving roads in Franklin County, and $30,000 for paving roads in the vicinity of the State Indian Reservations.

The Single Commissioner Plan for Peoria County, Illinois, is said to be favored by its present highway commissioners on the theory that one man who devotes his entire time to road matters can accomplish more than several men whose time is occupied with other interests.

Citizens of Northumberland County, Pennsylvania, have asked the aid of the state to secure the improvement of certain roads in the county, with special reference to that portion of state highway, route No. 161, running from Sunbury to Paxinos. The road is an old turnpike, and is one of the most important highways in that section of the state.

The Bridge Over the Ohio River between Parkersburg, W. Va., and Belpre, Ohio, has been in use slightly more than a year, during which period the tolls collected from a daily average of 600 pedestrians and about 100 vehicles have amounted to $18,000. The bridge is provided with street car tracks, and it is expected that an electric line will be operated over it at some future time.

MEETINGS

Calendar of Coming Meetings

May 23-24.—Michigan State Good Roads Association—Annual meeting, Saginaw, Mich. Secretary, A. A. Anderson, Hastings, Mich.

June 11.—New York State Conference of Mayors and Other City Officials—Annual Conference, Buffalo, N. Y. Secretary, W. P. Capes, 25 Washington Ave., Albany, N. Y.

June 26-30.—American Society for Testing Materials—Annual meeting, Atlantic City, N. J. Secretary, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

National Macadam Congress

Under the auspices of the Ohio Macadam Association arrangements are being made for holding the National Macadam Congress at Columbus, Ohio, in January next. The program will deal with the subject of good roads as a necessity in promoting the public welfare, especially that of rural communities. Delegates from a number of states and leading road builders are expected to attend the meeting. The headquarters of the association are No. 405 Hartman Building, Columbus, Ohio, and A. P. Sandles is secretary.

League of California Municipalities

The Public Welfare Exposition of municipal supplies and street and road making machinery is to be held at Santa Rosa, Cal., Sept. 24 to 29, in connection with the twentieth annual convention of the League of California Municipalities. An attendance of nearly 1,000 city officials from various parts of the state is expected.

Officers of the league are: President, W. Rutherford, Napa; Vice Presidents, L. A. Handley, President of Board of Public Works, Los Angeles, and F. C. Robson, Commissioner of Public Works, Berkeley; Secretary, H. A. Mason, San Francisco; Executive Secretary, Wm. J. Locke, Alameda; Director of Exhibits, Public Welfare Exposition, F. J. Erb, 962-4-6 Pacific Bldg., San Francisco, Cal.

County Wardens, Superintendents and Commissioners of Georgia

As previously noted, the third annual convention of County Wardens, Superintendents and Commissioners of Georgia will be held on Wednesday and Thursday of next week at Albany, Ga. Mayor M. W. Tift will deliver an address of welcome at the opening session Wednesday morning and the reports of committees will be read. In the afternoon John H. Mock, Secretary of the Chamber of Commerce, will speak. At 3:30 the business of the convention will be taken up. The election of officers will take place on Thursday morning. Special features of the convention will be a barbecue dinner at Blue Springs at noon on Thursday, and at 3:30 that afternoon an automobile trip over Dougherty County roads.

PERSONAL NOTES

W. R. Caldwell has been appointed City Engineer of Ypsilanti, Mich., succeeding R. D. Goodrich.

Frederick T. Elwood, City Engineer of Rochester, N. Y., since March 1, 1915, and former Commissioner of Public Works of the city, died at his home in Rochester on April 22 after a lingering illness.

L. C. Torrence has been appointed Highway Engineer of Road District No. 2, St. Francis County, Arkansas.

D. A. McCloskey, recently Road Superintendent of Huntingdon County, Pennsylvania, has been appointed by the Pennsylvania Highway Department as Chief of Construction at Hollidaysburg, Pa.

Ralph Volpe has been appointed Road Superintendent of Huntingdon County, Pennsylvania, succeeding D. A. McCloskey. Mr. Volpe has been with the Pennsylvania Highway Department four years.

Gaylord C. Cummin, at one time City Engineer of Dayton, Ohio, and for the past two years City Manager of Jackson, Mich., has been appointed City Manager of Grand Rapids, Mich. His salary is $10,000 a year.

B. C. Milbrath has been engaged by H. J. Carr & Co., general contractors, of Augusta, Ga., as superintendent on reinforced concrete construction work in the city. Mr. Milbrath was formerly connected with F. G. & A. C. Proudfoot, of Daytona, Fla., in charge of road construction.

C. Dwight Curtis, Assistant Engineer in Charge of Tests and Investigations, Iowa State Highway Commission, has resigned to accept a position as Testing Engineer with the J. B. McCrary Co., of Atlanta, Ga. He will establish and have charge of a field laboratory at Anderson, S. C.

C. M. Babcock, for several years Chairman of the Minnesota State Highway Commission, has been appointed by the Governor as Commissioner of Highways and head of the new Highway Department of the state. Mr. Babcock is the successor of the former state highway commission of three nonsalaried members. His term of office is 6 years and his salary $4,500 a year.

PUBLICATIONS

BALTIMORE COUNTY, MARYLAND. Annual report of the Roads Engineer for the year ending Dec. 31, 1916; paper 6x9 in.; 88 pp.; illustrated.

Included in this report are the following: a tabular statement of expenditures for the county; a detailed tabular statement of work done and expenditures made in the various districts accompanied by short reports; a tabular statement of concrete bridge and culvert work; an inset table showing the details of contract work in the county; a table showing roads oiled; a report on the road map of the county; and a general statement. The report is illustrated by a number of excellent full-page halftones showing improved roads, roads under construction and concrete bridges.

INDIANAPOLIS, IND., BOARD OF PARK COMMISSIONERS. 22d annual report, for the fiscal year ending Dec. 31, 1916; paper 6x9 in.; 75 pp.; illustrated; insets.

Included in this report are the reports of the board of park commissioners to the mayor and the reports of the horticulturist, forestry inspector, bureau of assessments, the engineer, the superintendent and the auditor. The illustrations consist of halftones showing scenes in the various parks and on the parkways in the city's park system. One of the insets is a reproduction of a drawing of the proposed golf and shelter house in Riverside Park, two insets are tables showing the distribution of maintenance costs and one inset is a map of the park and boulevard system of the city. The report is printed on heavy tinted paper and illustrated by excellent halftones.

GOOD ROADS

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Scenic Highways in Yellowstone National Park

The Yellowstone, the largest of the national parks, occupies the northwestern corner of Wyoming, extending a few miles west into Idaho and north into Montana. It has an area of over 2,142,000 acres and is celebrated not only for its wonderful mountain scenery, but especially for its geysers. The central portion of the park is a broad volcanic plateau ranging in elevation from 7,000 to 8,500 ft. above sea level. Around this are grouped mountain ranges with single peaks and ridges rising to a maximum of about 4,000 ft. above the general level of the plateau.

In addition to the natural wonders the park contains some of the most remarkable and impressive of the great engineering works carried out by the Government, not the least of which are the improved roads that have made the region accessible to tourists. In all there are about 200 mi. of improved roads in the park, and automobiles are allowed to use these under strict rules as to speed, distance apart, etc., laid down by the Department of the Interior, which has supervision over the park.

The roads are built and maintained by Government engineers. During the tourist season, from June to September, the park is divided into districts for road construction and maintenance purposes, each district being in charge of an engineer with a gang of workmen. The deep snows of winter, heavy rains, slides and washouts caused by streams formed by the melting snow frequently destroy long sections of road, and the repair of such damage and the oiling and ordinary repair work keep the maintenance forces busy. Some of the roads in the system are nearly 100 mi. from the nearest railroad and most of the materials for their construction, as well as materials for the building of other engineering works, has been hauled in by a fleet of 5-ton motor trucks. During last summer a truck of this kind is said to have replaced 30 horses in the hauling of supplies, equipment and materials to the men in the road camps. The truck was run 24 hours a day some of the time and, according to one of the road supervisors, covered from 125 to 175 mi. a day.

The 12-mi. road leading in from Yellowstone Station, one of the main entrances to the park for tourists who come by rail, is a water bound macadam road, 16 ft. wide, that is regularly oiled by the maintenance forces. It connects with the "circle trip" through the park at a point between Mammoth Hot Springs Hotel and Old Faithful Inn. The eastern approach to the park, leading across the "Buffalo Bill country"

ONE OF THE IMPROVED MAIN ROADS IN YELLOWSTONE PARK—OILED REGULARLY DURING THE SUMMER—60 MILES FROM THE NEAREST RAILROAD.

Scenic Highways in Yellowstone National Park

Top Left—Road over the Top of Sylvan Pass, Paved with Disintegrated Granite.

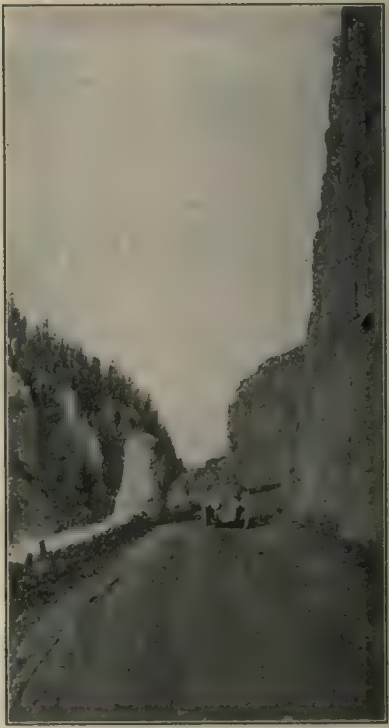
Top Right—Road in the Sylvan Lake Region.

Center Left—Road cut in the Solid Rock of Rattlesnake Mountain through the Shoshone Canyon.

Center Right—Road through Golden Gate on the Route to the Mammoth Hotel.

Bottom Left—Road and bridge in Gardiner River Canyon.

Bottom Right—Another view on the Gardiner River Route.



through the gorge of the Shoshone River and through Sylvan Pass, is 90 mi. in length and was improved at a cost of about $100,000. Particular attention was paid to making it smooth and safe for motor traffic. Part of the route is through the Shoshone Canyon, where in many places the road had to be blasted out of the solid rock of Rattlesnake Mountain, occasionally tunneling, as shown in one of the illustrations on page 308.

The roads are of water bound macadam or, in some cases, disintegrated granite, the latter surfacing material being taken from enormous deposits on the mountainsides, spread, and rolled. A road of this type, laid out through one of these deposits, is shown in the left-hand illustration at the top of page 308.

The building of roads suited to motor traffic and the opening of the park to automobiles have not only made touring possible to automobile owners, but has resulted in the announcement by the Yellowstone Park Transportation Co. that its 600 stage-coaches will be replaced by a fleet of 7- and 10-passenger White touring cars, thus putting motor trips through the park within reach of the thousands of tourists who do not have cars of their own.

Street Widening to Meet Traffic Demands*

By NELSON P. LEWIS†

One of the most difficult problems confronting towns and cities is the provision for the greatly increased street traffic which has developed during the past few years, especially since the introduction of motor vehicles. The first step in such relief is obviously that of traffic regulation, the object of which has been well defined as "the passing by artificial regulation through existing streets of inadequate capacity, with safety to both vehicles and pedestrians, of a larger volume of traffic than the streets would accommodate were the movement of both left uncontrolled."

A great deal has been accomplished by intelligent police regulation, but the volume of traffic increases so rapidly that further steps soon become necessary, such as the cutting through of new or the widening of existing streets in order to convert them into important traffic arteries. It is this last method of improving traffic facilities which is the subject of this paper. There are two separate kinds of problems involved:

I.—The widening of streets already congested, and,

II.—The widening of streets which are in use or which are only laid out upon the city plan where there is no traffic congestion at the present time, but where future congestion should be avoided.

I.—An increase in the traffic capacity of streets already congested may be accomplished in several different ways:

(a) By setting back the curb and increasing the roadway width and removing encroachments beyond the building lines in order to compensate for the narrower sidewalks, no change being made in the actual lines of the street. This is a simple method which will involve no expense to the public except that of the adjustment of the curb and pavement, but will require those who have been making use of a part of the public street for their own profit and convenience to remove encroachments at their own expense.

(b) An actual street widening by cutting off portions of the lots on one or both sides of the street, the improvement being carried out at a single step. This involves large expense, but will secure the desired results at once.

(c) A progressive widening by the establishment of new street lines, with the requirement that all new buildings erected shall be set back to the new lines and that all buildings which may be substantially altered, involving the building of new fronts, shall at the time of such alteration be set back to the new lines. This is a much more economical method, but the time required is often very long and the street during this progressive widening will present a very ragged and unsightly appearance.

(d) The widening of the roadway by appropriating practically all of the sidewalk space and the placing of the sidewalks in arcades back of the building line, easements on private property being acquired for this purpose. Such a plan will involve considerable expense and, unless there is some effective control of the architectural treatment of the building fronts, including the design and spacing of the supporting columns and uniformity in the height of the arcade, the results are likely to be very unsatisfactory, although with such control the streets so treated would gain in interest and picturesqueness.

II.—The avoidance of future congestion by the provision of adequate thoroughfares is, in many respects, a much simpler problem, although it is impossible to predict with any degree of certainty which streets may be called upon to accommodate exceptionally heavy traffic. Two methods of treatment may be resorted to:

(a) Streets of ample width can be provided at certain intervals or where their grades and their positions with respect to the general plan will render a concentration of traffic probable. The initial improvement of the roadways of such streets may be at much less than their ultimate width, the sidewalk space being left in grass plots or planted with shrubbery until the time comes when space must be added to the roadways.

(b) Setback lines or building lines can be established in addition to the regular street lines, no buildings to be erected on this space, although it may be used for the beneficial enjoyment of the owner of the abutting property. In this case the city would acquire the space between the street lines for a public street and acquire an easement of light and air for the spaces between the street lines and the building lines which spaces could be converted to street use when greater roadway capacity is needed. This plan has the advantage of insuring more generous light and air space and at the same time will permit an initial development involving less burden upon the abutting property for land taken and for street pavement.

The several methods of providing traffic thoroughfares can best be illustrated by a few concrete examples and, while these examples are taken from a few of the large cities of the country, some of them relate to suburban or partly developed sections so that the methods which have been followed will be applicable to cities and towns of much smaller size. Instead of grouping together improvements of this kind in a particular city, they will be grouped according to the classification above given.

I (a). New York affords some notable instances of roadway widening during the last few years. Perhaps the most conspicuous of these is that affecting Fifth Avenue. This street was laid out and acquired at a width of 100 ft. and was subdivided into a roadway of 40 ft. and sidewalks each 30 ft. wide. One-half of the sidewalk spaces had for many years been appropriated to private use. Many costly buildings had been erected, the entrances, steps and even supporting columns of which were within the street lines. In many instances fences had even been placed 15 ft. beyond the building lines and in the spaces enclosed by them there were sunken gardens and ornamental planting which added to the attractive appearace of the street. As the abutting property was gradually converted from residential to business use and as the traffic increased the roadway became inadequate, and it was decided that it should be increased from 40 to 55 ft. In order to compensate for the space thus taken from the sidewalks the removal of all encroachments beyond the street line was directed, although, in order to prevent the disfigurement of some very important and attractive buildings, it was agreed that owners who should, before a fixed date, remodel their buildings might retain such supporting columns or steps as would not encroach more than 2½ ft. beyond the building line. The entire expense of these changes had to be borne by the abutting owners. Considerable opposition was expected and there was some, but the change was so obviously in the public interest that, not only were the abutting owners soon reconciled to it, but the same treatment was soon extended to the entire length of this street south of Central Park. It has been estimated that the expense to the abutting owners aggregated about $2,000,000. The improvement was so marked that the same treatment was applied to a number of important crosstown thoroughfares and then to the narrower downtown streets in the financial district and those which serve as approaches to the ferries. Again there was some opposition, but in a number of instances property owners actually petitioned that the limits proposed in the resolution providing for the removal of encroachments should be extended. Other cities, notably Philadelphia, have considered or have actually taken steps to apply the same remedy. Where there are street railway tracks in the street the amount of the widening should, of course, be such as will accommodate one, two or more lines of vehicular traffic outside the railway tracks on each side. In the case of a single track 26 ft. will accommodate one line of traffic outside of the surface cars while two lines can be accommodated by a roadway 43 ft. in width. In the case of a double track railroad a single line of traffic outside of the surface cars would require 36 ft. and two lines of traffic about 53 ft.

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*Paper presented at the Ninth National Conference on City Planning, Kansas City, Mo., May 7-9, 1917.

†Chief Engineer, Board of Estimate and Apportionment, New York, N. Y.

I (b). The widening of an existing street at a single operation is expensive, but occasionally it must be done. Many examples of such undertakings might be given, only a few of which can be referred to.

Relief for the congested condition of Broadway, New York, was imperatively necessary when in 1893 the municipal authorities decided that Elm St., now known as Lafayette St., parallel with and about 50 ft. east of Broadway, should be widened. The old street was from 50 to 60 ft. in width, and this was widened to 80 ft., and extended at the last named width as an entirely new street for a distance of over 3,000 ft. The entire length of the new thoroughfare thus created was about 6,000 ft. The total cost for the acquisition of property was approximately $5,500,000, two-thirds of which was borne by the city at large and the remaining third was assessed upon an area of benefit about 3,000 ft. in width and 19,000 ft. in length containing approximately 1,280 acres. Owing to the irregularity of the property lines, remnants were left along the sides of the street which remained in an unsightly condition for many years and some of which have not yet been incorporated with the adjoining property, thus permitting the erection of buildings which would be suitable for a street of this importance.

A more recent example of the widening of an existing street and its connection by means of a new street with an established thoroughfare is that of the widening of Varick St. and the southerly extension of 7th Ave. in the Borough of Manhattan. When the plan for the upper portion of New York City was prepared by the commission created in 1807, a street system for what was known as Greenwich Village was already in existence and the new plan began on the northerly side of this district. No attempt was made to coordinate the irregular street system of Greenwich with the new plan to the north or the old plan to the south, and during all these years it has interposed a serious barrier to through traffic. Varick St. was widened from 65 ft. to 100 ft., this last being the width of 7th Ave. and its extension. The total length of the widening was 3,700 ft. and of the extension 2,700 ft. It was authorized in 1913 and, while the total cost has not yet been finally determined, it will approximate $6,000,000, all of which is to be imposed upon a local area of benefit and upon three of the boroughs, no part being assumed by the city at large.

One more example from New York is that of Livingston St., in the Borough of Brooklyn. This street is parallel with Fulton St., the principal business street of the borough, and about 300 ft. distant from it. The most important retail shops of this borough run from Fulton St. through to Livingston St., and the latter, which was only 50 ft. wide, was so badly congested by the delivery wagons of these shops that it was useless for other purposes. It was widened to 80 ft. in 1905 for its entire length of about 4,300 ft. at a cost of a little over $2,000,000. A double track surface railway was constructed in it and it has been of incalculable benefit to this part of the city. It was proposed to assess one-third of the cost upon property deemed to be benefited, but mandatory legislation was secured relieving these property owners and imposing the entire cost upon the city.

Philadelphia also affords a number of instances of the widening of existing streets. Perhaps the most important undertaking of the kind has been the widening of Delaware Ave. along and in the vicinity of the Delaware River. While this improvement has been in progress for some 25 years, it is not one of those progressively carried out in the manner described under I (c), but one section at a time has been undertaken as funds were available. This street will eventually extend from the Navy Yard on the south to Poquessing Creek on the north, a distance of about 17 mi. It was originally 50 ft. wide where in use and the new width will vary from 100 to 250 ft. The improvement has already been carried out at a width of 150 ft. between Fairmount and Washington Aves., a distance of 2 mi., and between Dyott and Cumberland Sts., a distance of ⅛ mi. The widening to widths of from 150 to 250 ft. between Washington Ave. and Hoyt St., about 2¼ mi., is now in progress as a part of the South Philadelphia improvement. In portions of this street there are or will be from two to six steam railroad tracks. No estimate can be given of its total cost, but it has been financed from the proceeds of bond issues and without any local assessment.

A more modest improvement in Philadelphia is the widening of Oxford Ave. through the village of Fox Chase. This was originally a toll road, 50 ft. wide. and is occupied by a double track surface railroad. It has been widened to 70 ft. for a distance of about 1,200 ft. through the center of the village. Some of the buildings were rebuilt and others were moved back to the new street lines, the amount paid in damages being about $57,000.

The comprehensive plan for the improvement of Chicago contemplates not only the cutting through of a numer of new streets, but the widening of important existing streets. Two of the latter improvements have already been undertaken. West 12th St. was originally 66 ft. wide from Michigan Ave. to Ashland Ave., a distance of 2 mi., while west of Ashland Ave. the street was much wider. There was no east and west street extending from Michigan Ave. to Ashland Ave. for a distance of more than ½ mi. south of West 12th St., and there were very few of such through streets to the north. In accordance with the plan referred to the portion of West 12th St., formerly 66 ft. wide, is now being widened to 108 ft., and is to have a roadway 78 ft. in width, with sidewalks of 15 ft. The estimated cost of the acquisition of property is $3,500,000, approximately one-half of which is to be assessed and the other half will be paid by the city. The assessment will be spread over a large area extending somewhat over ½ mi. north and south and about 2 mi. east and west.

Another improvement, which was also a part of the same general plan, is the widening of the portion of Michigan Ave. north of Randolph St. Between West 12th and Randolph Sts. Michigan Ave. is already about 130 ft. wide. North of Randolph St. it is to be given the same width as far as the Chicago River, while between the river and Chicago Ave. the existing Pine St. is to be widened so that this extension of Michigan Ave. will have a width of 141 ft. The widened street will have two roadway levels between Lake St. and Grand Ave., the upper level being continuous from Randolph St. to Chicago Ave., while between Lake St. and Grand Ave. it will pass over all of the intersecting streets, these latter connecting with the lower level only. The two level sections will include the river crossing which will be effected by a two-level bascule bridge. The estimated land and building damage for this widening is about $5,000,000, while the construction will probably involve a further expense of $2,500,000. Nearly one-half of the cost of the improvement will be borne by the city and the remainder will be assessed upon a large area extending north about 1 mi. to Lincoln Park and south about 3 mi. with a width of about 1 mi.

Two instances of street widening are taken from Boston, the first being what is known as the Pleasant St. improvement. This consisted of a widening from about 40 ft. to 60 ft. for a distance of about 1,700 ft. The work was carried out under a special act of the legislature passed in 1911, and the assessments were limited to one-half the cost and the area of benefit to a distance of 125 ft. from the line of the improved street or to the middle of the block. The total cost was about $681,000. About $137,000, or 20%, was assessed.

Another Boston improvement which it may be proper to include, although its purpose was not so much to widen a street already congested with traffic as to substitute for a narrow alley a street which might accommodate traffic, is what is known as the Avery St. improvement. This consisted of a widening from about 16 ft. to 40 ft. and it was also done under a special act of the legislature, with the provision that the assessments should be limited to one-half of the expense. Although the improvement extended for a distance of only 400 ft., the cost was over $1,300,000, of which amount $601,000, or about 46%, was assessed.

I. (c). The method of establishing new building lines and progressively carrying out a widening has been used very infrequently in this country, although it is quite a common practice in European cities. Probably the best examples in this country are to be found in Philadelphia. A well known instance is that of Chestnut St., formerly 50 ft. in width, which was widened to 60 ft. on the city plan by an ordinance adopted in 1884. It is a high-class retail shopping street and formerly had a roadway 26 ft. and sidewalks 12 ft. wide, the additional width being added to the sidewalks, the roadway remaining unchanged. Recent traffic counts showed about 4,600 vehicles passing a given point on this street between 5:00 a. m. and 9:00 p. m. The ordinance provided that after the adoption of the new lines no new buildings should be erected or any buildings should be rebuilt or altered without being made to conform with the new lines. The improvement has been in progress for 33 years, and has been completed for the greater part of the distance. As buildings have been set back the owners have filed petitions for damages and in general awards have been allowed for ground taken where the abutting lots were reduced to a depth of less than 100 ft., but where a 100-ft. lot remained no awards have been allowed. Up to the present time the awards have reached a total of more than $500,000. Walnut St. and Arch St., between the Delaware and the Schuylkill Rivers, are both being widened in this same manner, the former from 50 to 60 ft. and the latter from 66 to 72 ft.

One other instance will be taken from Philadelphia, namely, the widening of Frankford Ave. This might be considered a typical instance of the kind of widening described under II (a), portions of the street passing through undeveloped territory, while other portions were well built up and the widening involved considerable building damage. This street was part of the old Post Road between Philadelphia and New York and was 60 ft. wide. Through portions of the city which are well built up this width has not been changed. Through the suburban towns of Frankford and Holmesburg it has been widened to 70 ft. and this has been accomplished progressively by requiring the buildings that are rebuilt to set back to the new line. The distance through which the improvement has been carried out in this way is about 3 mi. It is said that no damages have been claimed, as the avenue is the principal business thoroughfare and the abutting property has ample depth.

I. (d). A few instances are to be found in this country of increasing the traffic capacity of a street by converting one or both of the sidewalks into roadway and placing new sidewalks in arcades under the buildings. Philadelphia again furnishes a notable example. Fifteenth St. between Market St. and South Penn Square has a width of 50 ft., with a roadway of 26 ft. and sidewalks of 12 ft. each. The curb on the east side was set back 11 ft. or within 1 ft. of the street line, while a sidewalk 19 ft. in width was provided back of the new curb line and extending 18 ft. under the buildings. This improvement was also extended eastward along the north side of South Penn Square between 15th and Broad Sts. The arcade thus formed has been treated uniformly, the supporting piers are regularly spaced and all of the same size, and the results of this treatement have been very satisfactory, the shops fronting on the arcade appearing to be desirable and they probably command good rentals. The total length of this arcade on both streets is 335 ft. and the cost to the city in damages paid for the easements and the reduction of available floor space in the buildings amounted to $193,000. Consideration is now being given to the extension of this arcade along the east side of 15th St. to Chestnut St., a distance of about 200 ft. It should be pointed out, however, that such treatment cannot be successful unless the arcades are of uniform height and unless the supporting columns and the facades of the buildings themselves are harmoniously designed. The arcades along the northerly side of the Rue de Rivoli in Paris and in the case of many of the streets of Berne afford excellent examples of what can be done in this way. When the new Pennsylvania Station was being erected in New York City the desirability of widening West 32d St., leading directly to the center of the easterly front of this building, was apparent. Contracts had already been made for the erection of buildings along this street and, as it seemed difficult, if not impossible, to secure an actual street widening, the suggestion was made that the entire street width should be converted into roadway and that sidewalks should be provided by constructing arcades on both sides through the entire block between 6th and 7th Aves., which has a length of 800 ft. Owing, however, to lack of ability to exercise any control over the designs of the facades of the buildings which might be erected, insuring a uniform treatment of the arcade and the supporting columns, the project was considered hopeless and the street remains 60 ft. in width, with a roadway of 30 ft.

II (a). Where the rapid development of a particular district may be reasonably expected or where it is necessary to provide more adequate street capacity in order that traffic may be accommodated and suitable transit lines may be constructed within the streets at some time in the future and expensive widenings may be avoided it is often necessary to lay out streets of generous width following the lines of existing roads, which now serve as connections between centers of population, the importance of which will probably increase. An excellent illustration of such a widening is offered by Queens Boulevard in the City of New York. This boulevard follows streets which had already been laid out and acquired at widths varying from 60 to 100 ft. It extends from the Queensboro Bridge across the East River to Jamaica, a distance of approximately 7 mi. It bisects the greater portion of the Borough of Queens, and its future importance as a traffic artery is apparent. For about 6 of the 7 mi. it was given the exceptional width of 200 ft. and for the remaining mile of 150 ft., the point of contraction corresponding with its junction with a proposed intersecting boulevard varying from 100 to 150 ft. in width. For the first mile the central portion of this street will be occupied by a three-track elevated rapid transit railroad built of concrete and of very attractive design. Beneath this will be located the surface railway tracks and there will be a wide traffic road on each side. The remainder of the boulevard, where the width is 200 ft., is to be divided into a central roadway of 44 ft. flanked on each side by park spaces of 30 ft. outside of which will be roadways 28 ft. in width, each one of which will accommodate a surface track railroad adjacent to the parked space. This generous width is, of course, designed, not for present needs, but for those of the future, and, inasmuch as the abutting owners had already provided a street varying from 60 to 100 ft. in width, only 20% of the cost of the acquisition of the land needed for the widening is to be assessed upon a zone extending 800 ft. on each side of the street, 30% is to be imposed as a special tax on the Borough of Queens and the remaining 50% is to be paid by the City of New York at large.

Another example is taken from Philadelphia and is that of Moyamensing Ave. This street was widened from 50 ft. to 148 ft. for about ½ mi. southwestwardly from Broad St., and this part of the street might perhaps be classified under I (b). Its extension southwestwardly, however, will be affected by the widening of Penrose Ave. from 50 to 248 ft., and it is designed to furnish a direct through traffic route between Philadelphia and Chester. The section 148 ft. in width is subdivided into two 18-ft. sidewalks, two 26-ft. driveways and a central planting space 60 ft. in width. This space, however, may subsequently be used in whole or in part for the widening of the roadways, for surface railway tracks or for a high speed elevated or subway transit line.

It may be difficult to convince the public that the provision of streets of this exceptional width years in advance of their actual need is at all necessary, especially where the cost of their acquisition is met wholly or in part by local assessment, and it is only by the exercise of somewhat arbitrary power by those possessed of vision that thoroughfares of these exceptional dimensions can be secured while the land is yet cheap and while there will be little or no damage to buildings.

II (b). The plan of making future widenings possible and economical by the establishment of setback lines is relatively new in this country, although in some Americaan cities there is a distinction between the street line and the building line. In most of our cities, however, these terms are considered to be synonymous. It may not be out of place to refer to the powers given to the Corporation of the City of Liverpool by an act of Parliament passed in 1908, one year before the British Town Planning Act became a law. The city may require any land owner who proposes to develop his property to lay out streets of such width as it may prescribe, with the provision that compensation need be paid only in case a main thoroughfare is required to be more than 80 ft. in width or any other street more than 36 ft. wide. Power also is given to require buildings to be set back any distance from the street which the authorities may determine, with the proviso that, if this distance is more than one-tenth the width of the street, compensation must be made. It will be seen that under this act, if a street is laid out at a width of 80 ft., the corporation may require setbacks which will give a width of 96 ft. between buildings without any compensation to the owners of the property.

Setback lines have actually been established in some of the smaller towns in this country. For example, in Winchester, Mass., building lines 20 ft. back of the street lines have been fixed for one street for a distance of ¾ mi. On the chief business street a setback of 15 ft. on both sides has been fixed for a distance of 1,000 ft., and on another main traffic artery setbacks of 20 ft. on both sides have been established for a distance of ½ mi., while in another case on a short section of a business street a setback of 10 ft. on one side and 12 ft. on the other has been prescribed.

The City of New York is now seeking legislation which will authorize it to include in the plan of the city, building lines as well as street lines, and a question which has been somewhat difficult to determine is what kind of title the city should take to the space between these two lines—whether an easement for light and air, which easement might be converted into a fee when a widening of the street becomes necessary, or a fee title as in the case of the space within the street lines, leaving in the abutting owner an easement for beneficial enjoyment but not permitting the erection of buildings, until such time as the space is needed for the widening of the street. It is believed that two important results would follow the adoption of such a policy. The first of these is the protection of those who may have improved their property under restrictive covenants providing for a setback. Such restrictions are usually for a limited period and, when purchasers have improved their property in accordance with these restrictions, it seems unfair that an owner of unimproved property may, after the expiration of the period for which the restrictions run, erect a building on the street line, blanketing his neighbor whose building has been set back in accordance with restrictions in force when he built. The establishment of such building lines before the expiration of the restrictions would protect the original developers and would go far to prevent a radical change in the character of the neighborhood. Another advantage is that it would be possible to lay out streets of a somewhat less width and with considerably narrower roadways, provided the space between the building line and the street line is sufficient not only to provide ample light and air but to make it possible to increase the roadway capacity when needed. It should, of course, be understood that ordinary adjuncts of the street, such as shade trees, lamp posts and even fire hydrants, should be located with respect to what will probably be the ultimate roadway width, so that the only change required when increased traffic capacity is needed would be the setting back of the curb, adjusting the sewer inlets and providing the additional roadway space.

Such a progressive development of streets is provided by what is known as the "flexible street ordinance" of Philadelphia, which was adopted in July, 1915. This provides that:

> Whenever any street is to be improved by grading, curbing, paving, repaving, macadamizing or other approved surfacing or by the planting of trees, if, in the judgment of the Board of Surveyors, the full width of the roadway as then confirmed is not immediately required and will not be required to accommodate travel and a temporary reduction in the width of said roadway is advisable and will result in economy of construction and maintenance, the Board of Surveyors shall direct that a plan be prepared for its approval showing the proposed widths and locations of roadways, footways and other surface improvements in accordance with the standard cross section for a street of that width . . . . and the said plan shall be followed in making all street improvements.

Another section of the ordinance provides that when, by reason of increase of traffic, a greater width than that shown on the above plan shall be required, the Bureau of Surveys and the Board of Surveyors are authorized to widen the roadway. Standard sections have been adopted by the Board of Surveyors for streets of different widths. For instance, for a street 70 ft. wide the initial improvement would include a roadway 26 ft. wide between curbs, lines of trees 8 ft. back of the curb, and paved footways 5 ft. in width, the inner side of which would be 6 ft. from the street line. As traffic needs increase the curb can be set back 5 ft. on each side, giving a roadway 36 ft. in width, with a strip 6 ft. wide between the flagged sidewalk and the curb, in the middle of which will be the trees.

One of the most ambitious projects for street widening to meet traffic needs which has come to the attention of the writer is that for the creation of a central traffic circuit in the City of Philadelphia. The purpose of this circuit is to provide what might be called adequate by-passes by which traffic which now passes through the one great center in the neighborhood of the City Hall may find its way around it, whatever may be the direction from which it comes and whatever may be its destination. It is proposed to widen Race, 8th, Locust, and 16th Sts. from their present widths of 50 ft. to a minimum of 134 ft. The widened sections of these streets would form a quadrangle 3,700 ft. in length and 2,800 ft. in width, enclosing no less than 40 city blocks. It is said that there is no serious opposition to the project and that it will undoubtedly be carried out as soon as the means for financing it can be found. Philadelphia has heretofore paid for improvements of this kind from the public treasury, but from a report presented to the mayor of the city in 1915 it is apparent that the city authorities are now studying the manner in which other cities have financed big improvements of this kind, at least in part, by direct assessment for benefit, and, if this plan is to be seriously considered in Philadelphia, it may be that opposition which has not yet developed will make itself heard.

While this paper has already been extended to greater length than was contemplated, a single illustration will be used to show the enormous expense involved in the correction of mistakes due to failure to provide traffic arteries of sufficient width to meet future demands. This is the creation of the Strand-to-Holborn improvement in London. The need of a direct connection between Holborn and the Strand was appreciated at least as early as 1836, when a plan for a thoroughfare to serve this purpose was presented to the public authorities. It was then proposed to give it a width of 50 ft. In 1838, in 1847, in 1855, in 1883, in 1889, in 1892, in 1895 and in 1896 the project was revived and on a number of occasions Parliamentary authority was asked to carry it out. Nothing was actually accomplished until 1899, when such authority was finally given, the improvement was at once undertaken and the new street was opened in 1905. Its estimated cost in its final form was more than $30,000,000 and the actual cost of the property taken was about $1,000,000 less than had been estimated. The years of agitation required to secure this much needed improvement and its enormous cost form as good an argument as can be presented to indicate the great importance of providing adequate traffic arteries without waiting for the need to become acute.

The information with respect to street widenings in Philadelphia has been obtained through the courtesy of Mr. B. A. Haldeman, Assistant Engineer, General Plans Division, and that relating to those in Chicago from Mr. C. D. Hill, Engineer, Board of Local Improvement, to both of whom grateful acknowledgment is made.

Gravel Highways for Labette County, Kansas

Under the new road law of Kansas, the County Commissioners of Labette County have planned to appropriate from the annual road fund the sum of $30,000 a year for the construction of a county road system. Under this provision the county will pay one-half the cost, the townships one-quarter, and the benefited districts one-quarter.

Large quantities of river bed gravel are obtainable from the Neosho River in the eastern part of the county, and it is the purpose of the road authorities to utilize this native material for the proposed system. It is estimated that this can be done at a cost of $1,000 to $2,000 a mi. for a 16-ft. roadway with gravel surfacing of from 5 to 10 in. and the proper drainage structures.

Rapid Development of Road Building in West Virginia

A recent review of road progress in West Virginia shows that of the $17,000,000 representing approximately the total amount of county bond issues for permanent road construction in the past 6 years, $16,411,500 has been voted since July, 1913—about 3 years. The large majorities by which recent issues were carried compared with the results or failures of bond issues passed upon two or three years ago indicate a rapidly growing sentiment in favor of highway development.

The success of the bond issue method of raising money for permanent road improvement has been due in a large measure to the active efforts of the present State Road Bureau, of which A. D. Williams, Chief Road Engineer, is the moving spirit. The following large amounts have been provided by the above method:

Greenbrier	$630,000	Upshur	$180,000
Brooke	800,000	Roane	448,000
Marshall	150,000	Wood	535,000
Wetzel	390,000	Kanawha	635,000
Monongalia	300,000	Fayette	1,050,000
Preston	446,000	Summers	250,000
Tucker	240,000	Mercer	850,000
Randolph	220,000	Raleigh	835,000
Mineral	275,000	Lincoln	675,000
Doddridge	375,000	Putnam	188,000
Harrison	300,000	Mason	150,000
Marion	2,075,000	Cabell	900,000
Barbour	135,000	Logan	200,000
Pleasants	60,000	Mingo	1,000,000
Ritchie	240,000	Wyoming	550,000
McDowell	$1,843,000		

Tourist Travel in Colorado

The total number of automobiles visiting Colorado during 1916 was placed by the State Highway Commission of that state in its latest report at 26,500. Assuming an average of four persons in each car, this makes the total number of tourists 106,000. The total amount of money expended in the state was estimated by the commission at $10,004,280.

The average number of persons per car was based upon replies to a circular letter, signed by State Highway Commissioner Ehrhart, which was sent out early in the year for distribution in Denver, Colorado Springs and Pueblo. The letter was as follows:

To Colorado Automobile Visitors:

Will you kindlv reply to the following questions:

1. How long do you expect to remain in Colorado?
2. What car are you driving?
3. How many in party?
4. What does it cost your party per day?
5. What is your opinion of Colorado roads? Have you any complaint, criticism or suggestion?
6. Please give name and home address.

These questions are asked in the hope of betterment of road conditions, and to get a glimpse of ourselves from your point of view.

The number of replies received was 76, distributed as follows: Kansas, 18; Oklahoma, 13; Texas, 13; Nebraska, 7; Iowa, 5; Missouri, 4; California, 4; Utah, 2; Colorado, 2; Illinois, 1; South Dakota, 1; Ohio, 1; Indiana, 1; Pennsylvania, 1; Florida, 1; Washington, 1; unknown, 1. It is stated in the commission's report that 88% of the comments made in reply to the fifth question in the letter were favorable.

Montoursville, Lycoming County, Pa., will vote on June 5 on a proposition for issuing $30,000 worth of road improvement bonds to join with the State Highway Department in improving roads in the county.

The Road from LaFayette to Wyoming, Ill., via Toulon, a length of 10 mi., is under improvement. The estimated cost is $10,000. When finished it is expected that the road will be one of the best in Stark County.

Minnesota Road Law Amended

An important feature of the new highway law of Minnesota is the amendment abolishing the state highway commission and the office of each of the persons constituting the commission, and, in place thereof, creating the office of commissioner of highways.

It is the intention of the act that the commissioner who is appointed by the governor, shall exercise in general the powers and duties of the former commission—a non-paid body of three members—and assume its organization, making such changes therein as may be desirable. The new organization is known as the "Highway Department." The commissioner of highways is appointed for a term of 6 years at a salary of $4,500 a year. He is required to give his entire time to his official duties, and he may be removed by the governor for cause. C. M. Babcock, who was chairman of the commission for several years, has been appointed commissioner of highways.

The law also abolishes the offices of "secretary" and "state engineer," and it creates the office of deputy highway commissioner. The appointment to this position is made by the commissioner of highways, and the one so appointed must be an "experienced road builder and engineer." His salary is fixed by the commissioner, at not to exceed $4,000 per year. He has charge, under the supervision of the commissioner, of the technical work of the assistant engineers. A requisite number of assistant engineers and other clerical or technical assistants may be employed by the commissioner of highways at salaries fixed by him, the maximum amount paid to any assistant engineer not to exceed $2,000 a year, excepting the first assistant road engineer and the chief bridge engineer. The commissioner and those appointed by him are allowed their expenses incurred outside of the state capital or county of residence. The assistant engineers may be assigned to one or more counties.

The total expense of maintaining the highway department, including the salaries of the commissioner and all his assistants and employees, and their necessary expenses incurred in the discharge of official duties in any year, which is payable from the state road and bridge fund, must not exceed 10% of the total fund available for such year, and the annual appropriation for the above purpose, exclusive of the salaries and expenses of assistant engineers employed outside of the office of the commission, must not in any year exceed $25,000.

Section 12 of the amended law makes the following rules and regulations regarding construction:

> As soon as the commissioner of highways shall have ascertained the location of the available road material throughout the state, and the best methods of road and bridge construction, as far as the same may be practicable, he shall prepare and adopt such rules and regulations for the construction, maintenance and improvement of state roads as shall be most suitable to the requirements of, and bring the most practicable results to, the several parts of the state.
>
> Such rules and regulations shall be printed and copies shall be forwarded to the county auditor of each county in the state for general distribution. Such rules and regulations may be amended from time to time, but such amendments must be printed and distributed not later than April 1 of each year.

The commissioner of highways is required to have all surveys, plans and specifications for state road work prepared by the department, and it is the duty of the commissioner, his deputy and engineering force to give assistance and supervision concerning road and bridge work whenever required throughout the state, and to render any additional services in the matter of engineering and surveying that may be required by the governor.

The highways of Minnesota are designated as "state roads," "county roads" and "township roads." The law provides that state roads shall be improved and maintained by the counties under the regulations of the commissioner of highways and under the supervision of an assistant engineer, but the provisions do not apply to a county which has or may have a population of 150,000 and over and a county highway superintendent or other officer to superintend its road work.

"County road" building is done under the authority of the county boards, and "town roads" are constructed and maintained by the town boards. The county boards also have power to appropriate and expend money from the "county road and bridge fund" for road improvement in towns and villages and for the construction and maintenance of roads in an adjoining county when the interests of the public would be served thereby, but the amount appropriated for the latter purpose must not exceed $20,000 a year. A town must maintain and repair a county road passing through it, except in counties of 150,000 population and in which a county highway superintendent is employed. Funds may be appropriated from the "town road and bridge fund" for the use of the county in the improvement of any road within a town that has been designated as a state road.

The state road and bridge fund of Minnesota is provided by a tax of one mill on each dollar of taxable property valuation, collected in the same manner as other state taxes, to which amount is added all moneys accruing, or that may accrue, from the income derived from investments in the internal improvement land fund, and all funds accruing to the state road and bridge fund from whatever source, all of which is expended under the direction and supervision of the commissioner of highways.

A reserve fund is created in the following manner:

> On or before the first Tuesday in April, 1917, and on or before the first Tuesday in January of subsequent years, the commissioner of highways, the state treasurer and the state auditor shall estimate the probable sum of money that will accrue to the state road and bridge fund during the current year and after first setting aside therefrom an amount not exceeding $50,000 for a reserve maintenance fund, to be expended as hereinafter provided, and also a sum not exceeding 10% of the sum it is estimated will accrue to the state road and bridge fund during the then current year, which sum shall constitute the expense fund of the highway department, shall apportion the balance of the state road and bridge fund among the different counties of the state as herein provided and shall immediately send a statement of such apportionment to the state auditor and to the county auditor of each county, showing the amount apportioned to each county for expenditure during such year.
>
> Not less than 1% nor more than 3% of the state road and bridge fund available in any year and remaining after setting aside the two funds hereinbefore provided for, shall be apportioned to any county.
>
> Any fund in excess of ⅓ of 1% of the total state road and bridge fund available for allotment in any one year, which, for a period of two years after such allotment shall remain unused and unexpended by such county, or for work done in such county, shall revert to the unapportioned funds in the state road and bridge fund and be thereafter and during the next succeeding year apportioned the same as other funds added to such state road and bridge fund by taxation or otherwise.

The apportionment of the fund to counties is made as follows:

> Not less than 20% nor more than 30% of the allotment so made to any county shall be used for maintenance of state roads and bridges thereon. Payment shall be made by the state to a county only for such proportion of the cost of maintenance of any road as is hereinafter specified with reference to the payment of state aid to such county for the construction or improvement of a state road therein.
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> It shall be the duty of the county board of each county in

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Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

MAY 26, 1917.

BUILD ROADS!

Road building must continue, war or no war. If we hope to win the war—and win it we must—we must build roads. If we want to reap to the full the benefits of the peace to follow the war, we must build roads.

The slogan "business as usual" has provoked much controversy since it was sugested, and some very strong arguments have been made both for and against it. Every one of the arguments for it holds true for "road building as usual." None of those on the other side are valid.

While the war lasts—whether that period is to be measured in weeks, months or years—we must continue to build new roads and maintain old roads, not upon the scale we have worked in the past but on a bigger scale.

We must increase our food supply, and because that is as much a problem of distribution as of production, we must have more roads and better roads. It will profit us nothing to raise bumper crops if we can not market them.

We must neglect no phase of military preparedness, and as has been demonstrated time and again in Europe in the past two and a half years, an adequate system of improved roads is one of the greatest military assets a country can have. Except for the improved roads of France, Paris would long ago have been occupied by the Germans and the great drive the Allies are now commencing would have small chance of success.

No false ideas of economy should be allowed to even temporarily check activity in road work in this country during the coming season. Often the surest way to save two dollars is to spend one, and just at present that principle can be applied most advantageously to road construction and maintenance. We need good roads today as we never needed them before and no one can say how badly we may need them tomorrow.

Every penny put into honestly performed, intelligently directed road work in America this season is a penny invested in the greatest material asset a country can have in war time or in peace, and is a penny spent for insuring the United States against the uncertainties of the future.

Those having control over road building in this country—in fact all who are working in this field—should avoid hysteria and settle down to build roads, more roads and better roads.

POLITICS AGAIN IN PHILADELPHIA STREET WORK

City street work, like all other public work, is apparently inseparable from politics, and the coming and going of public officials is so common a manifestation of political activity that it seldom seems worth while to make such a happening a subject of especial comment. Once in a while, however, there is a case so flagrant that a publication having at heart the interests of road building and road builders is in duty bound to criticise.

Such an instance occurred last week when Chief Connell of the Philadelphia Bureau of Highways and Street Cleaning was forced by the machinations of the Philadelphia "ring" to tender his resignation from a position he has filled with signal success during the past five years.

In 1912 Mr. Connell left a responsible executive position in the Bureau of Public Works of the Borough of the Bronx, New York City, to undertake the reorganization of the Philadelphia Bureau of Highways and Street Cleaning—at the time a purely political department organized and operated for the benefit of the political bosses of the city. The work Chief Connell did in reorganizing the department, revising the specifications for street work and introducing modern methods of engineering efficiency and economy in its operation has been described many times, and is more or less familiar to readers of "Good Roads." It was inevitable that in the performance of his duties he should antagonize those to whom the bureau had previously been merely a means to their political ends, and, according to reports, it was the enmity of the street cleaning contractors who had been accustomed to use the Bureau as they saw fit that finally forced his resignation.

Whatever the results upon the performance of Philadelphia street work, the incident can not fail to react to the injury of street work in general. It is the possibility of just such occurrences that deter so many of our ablest engineers from undertaking public work. No man likes to feel that his tenure of office depends upon his political activities rather than upon ability, nor do many men care to do their work under the conditions that must obtain in an office where they are constantly harassed by attempts to inject politics into the job.

Mr. Connell is to be congratulated upon his record in the Philadelphia Bureau of Highways and Street Cleaning—and upon the change he has decided to make. Philadelphia will lose an able and conscientious public servant; it is to be hoped that she will lose nothing more.

BUY A BOND

Among all those who do the world's really important work no class should excel the road builders in the practice of economy and frugality. Trained by education and experience to make a dollar do the work of two in their service to the public and obliged by their all too modest remuneration to follow the same course in their personal affairs, they know, as few others do, the real value of one hundred cents.

And their patriotism is beyond question.

Knowing these facts, we expect to find road builders of all classes well represented among the purchasers of the bonds the Government is offering in order to raise war funds.

While there are probably few not acquainted with the details of the plan, it may be well to call attention to some of its outstanding features. The denominations of the bonds and the method of floating the issue make it possible for almost anyone to invest. In fact participation is possible for anyone who can save fifty dollars in three months.

The smallest bond costs fifty dollars and can be purchased from a variety of agents, including banks and department stores. A bond can also be purchased on the instalment plan, the initial payment for a $50 bond being as low, in some cases, as a dollar. In New York City, for instance, bonds of this denomination may be obtained for $1 down, $9 on June 28, $10 on July 30, $15 on Aug. 15 and $15 on Aug. 30. Doubtless somewhat similar arrangements are to be found in other cities and towns. The bonds bear interest at 3½% per annum and are redeemable in 30 years. If at any time the Government issues other bonds paying higher rates, they can be secured to replace the present bonds.

From a purely selfish point of view the bonds offer an excellent opportunity for wise and safe investment. Interest at a rate equal to that paid by most savings banks is assured and the investment is as safe as any investment can be. In addition, there is the possibility of converting the bonds into others yielding a greater return, and a likelihood of the price going above par.

From the unselfish point of view, purchase of the bonds in accordance with one's means offers an excellent method of patriotic service.

Minnesota Road Law Amended

(*Continued from page* 314)

which state roads have heretofore or may hereafter be designated to provide for the proper maintenance of the same in accordance with the rules and regulations of the commissioner of highways.

In the expenditure of the funds for maintenance, preference shall be given to state roads improved as such and especially such state roads, to the cost of construction or improvement of which the United States has contributed.

The state's proportion of the cost of such maintenance shall be paid from the proportion of the allotment made to the county set aside for maintenance purposes, to an amount not exceeding the proportion set aside for maintenance purposes. Such payments shall be made upon reports to the commissioner of highways by the county auditor, after approval by the commissioner of highways, in substantially the same manner as is herein provided for the payment of the state's share of the cost of construction and improvement of state roads.

In case the county board of any county fails or neglects to maintain any state road as to which it is hereinbefore directed preference shall be given in the expenditure of the funds set aside for maintenance purpose in accordance with rules and regulations promulgated by the commissioner of highways, he may cause the same to be maintained and to pay the expense thereof from the reserve maintenance funds. * * * Provided, however, that the amount so expended in any one county in any one year shall not, together with the funds allotted to such county during such year, exceed an amount equal to 3% of the total state road and bridge fund available for allotment and expenditure during such year; and provided further that an amount equal to any sum so expended by the commissioner of highways in any county during any one year shall at the time of the next allotment of the state road and bridge fund be deducted from the allotment which would otherwise be made to such county and the amount so deducted shall be credited to the reserve maintenance fund. * * *

The amount which shall be paid by the state out of the allotment of the road and bridge fund, to any county as state aid, in the construction or improvement of any road or bridge in any county in any year, shall be as follows:

In counties where the assessed value of the property for taxation purposes is less than $5,000,000, 80%; in counties with a taxable valuation $5,000,000 and less than $10,000,000, 70%; in counties with a taxable valuation of $10,000,000 and not exceeding $15,000,000, 60%; in all other counties 50%. In determining the taxable valuation hereinbefore provided for, the assessed valuation of moneys and credits provided for in Chapter 285, General Laws of 1911, shall be excluded. The proportion of the cost of constructing any road or bridge above specified shall be paid by the state only in case the funds apportioned to any given county, over and above the amount set aside for maintenance, as herein provided, shall be sufficient therefrom.

The county road and bridge fund is set apart by the county board for the construction and maintenance of state and county highways and bridges in the county. In the matter of issuing bonds for road improvement, a petition signed by 50 or more voters who are also freeholders must first be presented to the county board. The board may then request that an estimate of the cost of the proposed work be made by an assistant engineer, and if the estimate is received more than 6 months prior to the date of the next general election, a special election may be called by the board, in its discretion, for the purpose of submitting the question to the people. No issue may be made when it would make the entire indebtedness of the county exceed 15% of the assessed valuation of taxable real property therein, not computing the cost of drainage ditches which is assessed against the benefited property. County bonds bear interest at not exceeding 6% per annum and have a life of 20 years. A tax sufficient to meet the interest and principal must be levied by the county auditor. The annual tax levy permitted by law may include an additional 5 mills on the dollar, for the county road and bridge fund.

The county board has control of the establishment or vacation of county roads, except those established by judicial authority.

Road dragging is made obligatory under the following provision:

> The county auditor of each county shall annually extend upon the tax lists of his county, in the same manner as is provided by law for extending the county school tax, a tax of 1 mill on the dollar of the taxable property in each town, outside the corporate limits of any borough, village or city in any such town; provided, that in towns having an assessed valuation of $1,000,000 or more, the amount of such tax shall not exceed $1,000. * * *
>
> The proceeds of such tax levy shall be kept in a separate fund to be known as the "dragging fund" and shall be expended by the town board only for the expense of procuring a suitable number of drags and dragging the roads of the town; in putting straw on sandy roads and removing snow from town and county roads.

The extraordinary improvement of an established road in any town at an expense greater than any amount the town or county has authority to make appropriation for is provided for by a petition and election in a manner similar to that followed in the issuance of county bonds.

The law contains very complete provision for drainage, and it extends authority to county or town boards to purchase or secure by condemnation "any plot of ground, not exceeding 20 acres, containing gravel or stone, or clay, or sand or one or more of such road materials, suitable for road purposes, together with the right of way to the same of sufficient width to allow teams to pass, and on the most practicable route to the nearest public road."

The construction of toll bridges over the Minnesota River is regulated by the following section of the highway laws:

> Any corporation organized for the purpose, or any counties, towns, cities or villages interested, may jointly or separately erect and operate a fixed span bridge over the Minnesota River at any suitable point, down to and including the borough of Le Sueur. All such bridges erected over said river below Le Sueur shall be provided with a suitable draw, with an opening of not less than 80 ft., which on reasonable signal or notice, shall be opened to allow the passage of vessels. Before any such bridge is erected, the location and plan thereof shall be approved by the governor.

The rates of toll are fixed as follows:

> For each foot passenger or bicycle rider, 5 ct.; for each hog, sheep or calf, 2 ct.; for each head of cattle, 5 ct.; for each vehicle or sleigh drawn by one animal, 20 ct.; for each additional animal used, 5 ct.; for each automobile, 20 ct.; for any other vehicle or animal, a reasonable rate of toll. Such rates of toll may be changed by law whenever the net annual income from such bridge shall exceed a reasonable percentage of the cost thereof.

Bridges over navigable rivers may be built without a draw by providing a clear height above the water stage and clear width of opening sufficient to accommodate the general navigation of the river, but the project must first be approved by the chief engineers of United States Army and by the Secretary of War.

Chapter 52 of the amended law, approved March 5, 1917, provides for the issuance of bridge bonds in an amount not exceeding one-half of 1% of the assessed valuation of taxable property within a county without the necessity of submitting it to a vote, upon the petition of 25 or more freeholders, when the county has no outstanding road and bridge bonds and the proposed work is deemed advisable, but the act is not intended to limit the power of a county or county board under existing laws.

Chapter 75, also passed at the last session of the legislature, authorizes county boards to levy taxes to comply with the requirements of the federal aid road law.

Members of Nevada Department of Highways Appointed

As previously noted in these columns, the 1917 legislature of Nevada enacted a law creating a department of highways to consist of three directors and a state highway engineer. The directors have been appointed by the governor, as follows: James M. Leonard, of Virginia City, tenure of office, 3 years; George K. Edler, of Reno, 2 years; and W. B. Alexander, of Reno, 1 year.

New Montana State Highway Commission

The present State Highway Commission of Montana consists of twelve members appointed by the Governor from the twelve highway districts into which the state is divided. The districts are represented as follows:

No. 1 (Lincoln, Flathead and Sanders Counties), F. H. Johnson, of Kalispell, appointed for 4 years; No. 2 (Mineral, Missoula and Ravelli Counties), D. T. Curran, of Missoula, 1 year; No. 3 (Beaverhead, Madison and Gallatin Counties), C. M. Buford, of Virginia City, 2 years; No. 4 (Silver Bow, Deer Lodge and Granite Counties), Oscar Horne, of Butte, 2 years; No. 5 (Lewis and Clark, Broadwater, Powell and Jefferson Counties), Frank Conley, of Deer Lodge, 3 years; No. 6 (Cascade, Musselshell, Meagher and Fergus Counties), H. A. Templeton, of Great Falls, 4 years; No. 7 (Chouteau, Teton, Hill and Toole Counties), C. W. Morrison, of Fort Benton, 1 year; No. 8 (Blaine, Sheridan, Valley and Phillips Counties), A. W. Mahon, of Glasgow, 3 years; No. 9 (Carbon, Stillwater, Sweet Grass and Park Counties), Samuel Weed, of Columbus, 2 years; No. 10 (Rosebud, Yellowstone and Big Horn Counties), A. N. Richardson, of Forsyth, 1 year; No. 11 (Custer, Prairie and Fallon Counties), H. R. Wells, of Miles City, 3 years; No. 12 (Wibaux, Dawson and Richland Counties), T. F. Hagan, of Glendive, 4 years.

Prison Labor in Minnesota

Prison labor in Minnesota has contributed largely to road betterment in that state, according to the latest report of the State Highway Commission.

During the past five years the State Reformatory at St. Cloud has supplied about 40,000 cu. yds. of crushed granite, worth approximately $60,000, for road building. This output was used in Anoka, Benton, Chisago, Crow Wing, Isanti, Meeker, Mille Lacs, Morrison, Renville and Sherburne Counties.

In 1916 the Reformatory and Sherburne County cooperated in the prosecution of what is described by the State Highway Commission as "the first substantial prison labor road job" in the state. The work consisted of the building of 2 mi. of macadam road through the prison property. Crushed stone to the amount of 4,455 cu. yds. was furnished by the Reformatory, which also supplied 1,051 cu. yds. of gravel. The authorities of Sherburne County and the Automobile Club of St. Cloud furnished teams for hauling and grading, the City of St. Cloud furnished the road roller and its operator, and the Reformatory, besides supplying the gravel and crushed stone, furnished a labor force of 10 inmates.

Songs of the Street

The appended verses which were inspired by the occasion of a complimentary dinner given to President Marks of the Borough of Manhattan on the evening of May 19 not only indicate how the 1,400 employees of the Department of Public works of New York City who tendered the dinner regard their work, but reveal an unexpected poetic side to what is usually considered a prosaic subject:

The Maintenance Division

(Air: Mother Machree)

There's a spot in New York where boss system holds sway;
They are dandy good systems, but changed every day;
Where the pavements are bad they can tell at a glance;
But for making repairs, sure they don't get a chance.
Sure there's one, two and three strikes and memos galore,
But the pink slips wake up the emergency corps;
And the little six Buick starts out on its way
For to pile up more dope for the system next day.

Highways

(Air: An Irishman's Dream)

The pavement was finished on Broadway,
Not a cut nor a trench could be seen.
Repairs were all made, and the curbs laid to grade;
The complaint book for months had been clean;
The sidewalks were clear of encroachments,
The taxpayer's wish was supreme—
Newspapers gave praises,
We all got good raises—
'Twas only an engineer's dream.

The Sewers

(Air: Knock the "L" Out of Kelly)

If you knock the "S" out of sewers,
And you take the basins away;
It may appear strange but the streets would soon change,
And not so resemble a mountainous range.
You may take off a man from the payroll,
You may lay off a horse and a cart,
But don't take the basins from sewers,
Or sewers and highways will part.

NEWS NOTES

St. Joseph County, Indiana, will issue bonds for $87,000 for the purpose of constructing a bridge over the St. Joseph River at Mishawaka.

The Florida State Good Roads Association is to establish a Hotel and Garage Bureau for the accommodation of automobile tourists in Florida.

A Contract for Building the Whitewater River Bridge, at New Castle, Ind., has been awarded to Isaac E. Smith, of Richmond, on a bid of $169,990.

The City of Joplin, Mo., is carrying on a vigorous campaign for raising $100,000, its portion of the cost of constructing a road from Joplin, Mo., to Miami, Okla.

Plans for a Belle Isle Bridge at Detroit, Mich., are being considered. They call for a bridge 86 ft. wide, and without a draw, with a 30-ft. clearance above the water.

The Force at Work on Pennsylvania State Highways is the largest employed during any May in the history of the State Highway Department. The total number of men at present employed is about 5,000.

The County Commissioners of Pacific County, Washington, have ordered a special road bond election for June 12. The bonds to be voted upon, $280,000 in amount, will be utilized if the issue carries, in constructing a system of permanent highways through the Willapa valley and in opening up the last link in the National Park Highway connecting the northern and southern portions of the county.

MEETINGS

Calendar of Coming Meetings

June 12-14.—New York State Conference of Mayors and Other City Officials—Annual Conference, Buffalo, N. Y. Secretary, W. P. Capes, 25 Washington Ave., Albany, N. Y.

June 20-22.—Texas Good Roads Association.—Midsummer Convention, Mineral Wells, Texas. Secretary, D. E. Colp, San Antonio, Texas.

June 26-30.—American Society for Testing Materials—Annual meeting, Atlantic City, N. J. Secretary, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

Texas Good Roads Association

The midsummer convention of the Texas Good Roads Association will be held at Mineral Wells June 20 to 22 inclusive. The annual meeting of the Fort Worth-El Paso Highway Association is scheduled for the same time and place. An invitation has been tendered the Reclamation, Conservation and Irrigation Association of the state to hold its meeting at Mineral Wells during the same week.

Arrangements are being made to have the good roads people assemble at Fort Worth on the night of the 19th. A large parade is planned for the morning of the 20th through the main streets of Fort Worth, after which the delegates and visitors will proceed in a body to Mineral Wells. The program of the convention is in preparation, and a large attendance is expected.

Resolutions Adopted at a Good Roads Convention at North Bend, Oregon

At a road convention held at North Bend, Ore., on the 19th of last month the following resolutions were adopted:

Whereas, our country has been abruptly forced into the great world-wide war, as one of the belligerent nations, and we are now face to face with actual war and all its hazards, and in consequence of which the nation has been aroused to the startling realization of the inadequacy of its preparation for the impending conflict and is now working out with all possible urgency the most expeditious as well as effective measures for both offensive and defensive military preparation; and,

Whereas, in the perplexing circumstances of this emergency we believe it would be both wise and expedient in determining what course of action is best, to be guided very largely by the lessons resulting from the battlefields of Europe during the past three years; and,

Whereas, the most important as well as the most emphatic of all these lessons is the outstanding fact that a properly designed and well-constructed system of public highways is the fundamental basis of any scheme of national defense which can be relied upon in the final crisis, as such highways, strategically located and properly constructed, are in many instances more serviceable than railroads, for they can never be completely congested nor completely destroyed; and,

Whereas, it has been repeatedly and conclusively demonstrated that fortifications, however elaborately constructed and seemingly impregnable, are comparatively useless and easily destroyed when assaulted by the modern long-range gun and the high-explosive shell, and that a much more efficient system of defense is afforded by movable batteries of heavy, long-range ordnance which can be quickly transported and assembled at commanding salient emplacements, previously prepared, operating over a network of military highways; and,

Whereas, the cost of constructing one fortification, which could be completely destroyed within a few hours, and at best affording only doubtful protection to one locality, would be equivalent to the cost of constructing scores of miles of first-class military highway affording even better protection to many localities, and the expense of maintenance would be practically the same in either case; and, in times of peace, the fortification would be only a useless and expensive incumbrance while the highway would be even more useful as an economic resource than as a military asset; and,

Whereas, the universally recognized axiom, that the strength of a chain is measured by its weakest link, so is a nation's military defensive power estimated by its weakest and most unguarded frontier, therefore as there are hundreds of miles of shore-line along the Pacific Coast totally unprotected and absolutely inaccessible from the interior, but easily approached and open to attack from the sea, it is obvious that not only the Pacific Slope, but the entire country is wide open to hostile invasion, now imminent at any moment; therefore, be it

Resolved, by the citizens of North Bend and Coos Bay, Oregon, in convention, this the 19th day of April, 1917, assembled to discuss and consider the problems of state highways, but especially the proposed Pacific Coast Military Highway, that we view not only with serious concern but with actual anxiety, the contingency of hostile demonstration against the exposed ports and cities of the Pacific Coast with absolutely no means of defense whatsoever; and we urge immediate national consideration of the proposed Pacific Coast Military Highway, paralleling the coast line from Puget Sound to the Mexican boundary, as the most feasible and expedient defensive measure attainable within reasonable limits of cost and time, and that in event of an international peace settlement this military highway would be of even greater value as an avenue of commerce and a prime factor in the economic development of the Pacific Slope than it is now as a military necessity; and be it further

Resolved, that we call upon our representatives in the National Congress to present this matter in some concrete form for legislative consideration and action at the earliest practicable time.

Michigan State Good Roads Association

The ninth annual convention of the Michigan State Good Roads Association was held at Saginaw, Mich., on Wednesday, Thursday and Friday this week. A special feature of a program of unusual interest was the Road Commissioners' Day, Thursday, May 24, in charge of F. F. Rogers, State Highway Commissioner of Michigan. The program for Friday was in charge of the Department of Civil Engineering of the University of Michigan.

The Waynesboro, Pa., Automobile Club met on May 16 in the interest of road betterment in Franklin County. The club is making an effort to secure the improvement of the Quincy Road from Fayetteville to Waynesboro and the abolition of toll roads in that section of the state. H. W. Fry, Chief Clerk of the Pennsylvania State Highway Department, who was present, explained the plans of the department for building up a main arterial system of highways connecting the various county seats and thickly populated centers of the state, to be followed by the improvement of laterals leading into the main highways. He also pointed out some of the problems with which the department has to deal in carrying out its road building program.

Bids for Road Construction in Pennsylvania will be opened on June 12 on work to be done in Center Township, Green County, and on various sections of roads in Dauphin, Clarion, Allegheny, Cambria and Washington Counties, for which bids were recently rejected, as noted in "Good Roads" of May 19.

A Bridge to Span the Mississippi River at Lyndale Ave., Minneapolis, Minn., is to be constructed by Hennepin and Dakota Counties jointly, at an estimated cost of $450,000, for which a bond issue has been authorized. The work includes the building of 7 mi. of permanent highway as the Hennepin County approach, and 10 mi. of gravel as the Dakota County approach, and repairs to Cedar Ave. Bridge costing $40,000.

LETTERS TO THE EDITOR

Let Us Look Squarely at the Transportation Problem

Editor "Good Roads:"

Without a single exception, men engaged in a business requiring shipments by freight from one point to another during the past year have bitterly complained of the tardiness and ofttimes utter inability of the railroads to care for their needs. Thousands upon thousands of tons are just now awaiting the insistent demand for cars in which to load. Thousands of cars are standing in the outer yards awaiting their turn for placement on some unloading track, while others, patience and expensive delay no longer to be endured, are unloaded miles out of the city and the contents trucked to destination.

What might have been due to a farsighted plan of railroad terminal facilities for cities that doubled and tripled their population in a decade, the yard plan, the trackage room, for cities of a few thousand that now have completely outgrown all preconceived proportions of growth, is idle to discuss.

Mines have been made idle; manufacturing plants have ceased operations for days; grain, so badly needed, remains in farmers' cribs, and all business is disturbed. Reflecting results are felt in lessened efficiency on the one hand and higher prices for all purchases needed for our daily requirements on the other. Our whole industrial fabric is being sapped of the vitality that we need and upon which the great strength of the country rests, and upon which we must depend for continued ability to endure the coming strain.

There may be unscientific management, but railroad trouble is not all due to inefficient use of what they already have. It is due mainly to what they have not. It is a condition that can not be improved upon or added to within sufficient time to meet the exigencies that are upon us.

The United States Government recognizes the existence of this industrial condition by giving preferential right of way over railroads to commodities for direct and immediate war needs. As the necessities for war material become expanded the general industries of the country will be further disturbed by the increased use of present transportation facilities. This situation will surely become intensified by the great increase of crops, so wisely urged upon the country, which must be moved if they are to serve the purpose of feeding the thousands now so anxiously hoping for a further lease of life thereby.

It is quite apparent that transportation is no longer a problem of mere convenience, nor is it one of merely commercial advantage. It is now a question of bread and meat, and more. Upon it rests the hope of an early conclusion of the war. It is a question of vital and immediate concern for the salvation of the country, the guarantee of its ultimate endurance.

In what manner and how shall the relief come? Shall it be either a matter of debate or procrastination, or shall it come at all? If we have been unable to deliver a short crop how shall be deliver a long one?

The United Press during the past winter sent out a dispatch from Columbus, Indiana, evidently intended to appease the appetite of the reader in the comedy of the circumstances, but which bore a lesson so plain and impressive that the tragedy of present events ought to stir to action. Said the dispatch:

> Providence has been kind to the southern Indiana farmers this winter in that once in a lifetime the roads are frozen in a smooth condition, and, taking advantage of such roads, hogs are sent to market, 75 mi. away, in an auto truck. The hogs so enjoy their ride to death that they go to sleep on the way.

We are not so helpless that we may expect to survive by merely putting the manna in our mouths. More is expected of us these days.

When Providence is kind enough to point out so particularly and exactly the way, why need we be either dense or stubborn—much less careless and indifferent?

Rome fed a million people with slow moving ox carts over her roads. We have no ox carts, but we have fast moving trucks. We have no Roman road; in fact, we have no roads. But we have sufficient stretches and patches to create confidence in our ability to build them. We do not have to await a providential smooth, frozen surface. If progress in railroad building from the old iron banded wooden stringer through stages of different gauges up to the standard truck and schedule of movement is still inadequate to serve the public up to its needs, how much less has been our progress in highway building?

Our main traveled roads, at least our through trunk highways, should have the same reliability for the truck, horse or gas propelled, as a railway track has for its loaded cars.

Evidence of the most convincing character as to the needed types of road is abundant upon which to exercise judgment in the building of roads dependable for the most exacting and constant service. To hesitate either over a program for immediately improving such highways as will relieve the railroads of an excess of tonnage, or of rapidly extending mileage and connecting stretches already in existence, is to be guilty of a criminal neglect well-nigh approaching treason.

True, all this is to sustain in virile condition the elements of national life and strength behind the firing line, but in no less degree can the highways be utilized in many eventualities for actual military requirements.

Nor can the vicissitudes of war lessen by a single farthing the value of the dollar now expended; it will be one of continuous worth in the peaceful days to come.

WILL P. BLAIR,
Secretary, National Paving
Brick Manufacturers' Association.

Cleveland, Ohio.

How Road Money Has Been Wasted

Editor "Good Roads:"

Of the $300,000,000 spent on road work last year probably a third was wasted. This condition is the fault of the taxpayers primarily. They have not called for businesslike administration and they have not received it. It is this popular contentment with slipshod methods that is the greatest obstacle in the way of rational road improvements today. It is absolutely necessary to improve our method of administering our road affairs by local authorities, in many cases, before it is wise to undertake large expenditures. It is particularly necessary to introduce proper accounting systems on all road work. We should have more results from the money we are spending through local officials and we can not obtain them until the accounting methods which are necessary to successful business are adopted by these local authorities.

The pressing road problem of the country today is not so much to provide money for our highways and byways as it is to awaken the average taxpayer to a knowledge of the business side of the work for which he is contributing so liberally that he may enlist the help of the ablest business men and the services of competent engineers and supervisors in carrying it on. There is no question as to the correctness of this statement. The expenditure of road funds and the direction of road work by men of special training or capacity for the work is very often the exception rather than the rule. Many a county has spent enough money to have good roads, but has poor, because that money has not been judiciously spent. It is not a question of dishonesty, in most cases, but of incompetence.

The recently established state highway commission of this state should prevent such wholesale recklessness of expenditure as has been common in the past. The entrance of the federal government into the active work of road building should give more efficient supervision everywhere than has been the rule, but neither the commission nor the government can insure taxpayers the value received for their road money if those having authority over road construction will not insist that accurate accounts be kept of every dollar and that the most competent men obtainable be placed in charge of the work.

The writer having had fifteen years' experience in the construction of roads and bridges, is in position to know the facts.

ADOLPHUS EDWARDS.

Leesburg, Fla.

PERSONAL NOTES

A. R. Topping, who has been associated with the Walter A. Zelnicker Supply Co., of St. Louis, Mo., for the past eleven years, was elected Secretary of the company at a meeting of the Board of Directors on April 19.

William E. Kimball, City Engineer of Attleboro, Mass., and his assistant, C. E. Jewell, met with a fatal automobile accident on May 2. L. J. Ainsworth, a construction foreman of the State Highway Commission, who accompanied them, was also killed.

John H. Mullen, former Deputy Road Engineer of Minnesota, has been appointed Deputy State Highway Commissioner by C. M. Babcock, State Highway Commissioner, who, under a recently enacted road law, succeeded the old state highway commission thereby abolished.

W. F. Pollard, formerly Student Assistant in the Department of Tests and Research in the U. S. Office of Public Roads and Rural Engineering, has been appointed Inspector of Roads for the State of Kentucky, with headquarters at 429 W. Broadway, Louisville, Ky.

Robert C. Terrell, former Commissioner of Public Roads of Kentucky, who has been connected with the Department of Civil Engineering at the University of Oklahoma, at Norman, has been promoted to the rank of Associate Professor in charge of the new Department of Highway Engineering, which is a branch of the School of Civil Engineering, in the College of Engineering at the University.

Resignation of William H. Connell

William H. Connell, for about five years Chief of the Bureau of Highways and Street Cleaning of the Department of Public Works of Philadelphia, Pa., has tendered his resignation, effective May 31. He is to become connected with the firm of Day & Zimmerman, 611 Chestnut St., Philadelphia, as Engineering Executive. This company in addition to its regular work of managing and reorganizing corporations will also, according to reports, engage in ship building and in other lines of engineering incident to the demands expected to be made by the Goverment.

Chief Connell's resignation followed the action of the City Council in taking away from his bureau the work of street cleaning and placing it under a new bureau, this action reresulting from a series of political attacks upon Mr. Connell's office. He was appointed by former Mayor Blankenburg in 1912 and has since completely reorganized the bureau, building up an efficient engineering organization which has attracted attention throughout the country. Philadelphia's street cleaning under the existing laws has to be done by contract and it was through Mr. Connell's firm stand in forcing contractors to live up to their contracts that he incurred the enmity of the so-called "organization."

PUBLICATIONS

NEWPORT, RHODE ISLAND, STREET AND HIGHWAY DEPARTMENT.—Annual report for the year 1916; paper 6x9 in.; 56 pp.

This report includes detailed statements of the work of the Street and Highway Department of the city, including snow removal, street cleaning and sprinkling, pavement construction and repair, and sewer work. There are included several tables showing the details of street work, an inventory of the department's property and a financial statement.

PUBLIC ROAD MILEAGE AND REVENUES IN THE CENTRAL, MOUNTAIN, AND PACIFIC STATES, 1914, prepared jointly by the Division of Road Economics of the Office of Public Roads and Rural Engineering, U. S. Department of Agriculture, and State Collaborators; Bulletin No. 389, U. S. Department of Agriculture, dated May 10, 1917. Paper, 6x9 in., 56 + lxxv pp.

This bulletin is a report showing the mileage of improved and unimproved roads and the sources and amounts of road revenues, and including bond issue data, from the states in the groups included in the title, with descriptions of the systems of road management and other phases of highway work in the states covered. It supplements Bulletins Nos. 386, 387 and 388 previously issued covering, respectively, the Middle Atlantic States, the Southern States, and the New England States, and concludes the series on road mileages and revenues in 1914. Its arrangement follows that of the other bulletins, the first part of the book consisting of descriptions of the road situation in each of the states with a review of the work done, and the latter part of the book consisting of tabular data on road mileages and revenues.

HIGHWAY BONDS. A Compilation of Data and an Analysis of Economic Features Affecting Construction and Maintenance of Highways Financed by Bond Issues, and the Theory of Highway Bond Calculations, by Lawrence I. Hewes, District Engineer, Office of Public Roads and Rural Engineering, and James W. Glover, Professor of Mathematics and Insurance, University of Michigan; Bulletin No. 136, U. S. Department of Agriculture, Revised March 6, 1917. Paper, 6x9 in., 78 pp., illustrated, insets.

This bulletin, the contents of which are clearly indicated by its subtitle, is a revision of Bulletin No. 136 dated Feb. 12, 1915, and is practically the same in contents and arrangement except that the tables of highway bonds issued included in the former publication have been omitted from the revision. The text includes a discussion of the financing of highways with special reference to the bond issue method, with a number of tables showing application of the principles stated. The second part of the book, "Highway Bond Calculations," contains a detailed mathematical discussion with formulas on the theory of interest as applied to bond calculations. This part includes a number of tables of interest, annuities, etc. The illustrations consist of half-tone reproductions of good and bad roads, a chart showing county bond issues and the principles of financing by bond issues There are included maps of county road systems.

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The Kansas City Park System and Its Effect on the City Plan[*]

By GEORGE E. KESSLER[†]

Kansas City, until its park system was recommended, built itself, like practically all other cities of the country, with little reference to the future. It began as a landing place of the early fur traders of the Missouri Valley who passed back and forth to what is still the great fur center of the country, St. Louis. Later, steamboats made Kansas City a landing for Westport, 4 mi. south, Westport being one of the Missouri River towns from which the wagon trains passed over the great Santa Fe Trail across the western plains into New Mexico. The trade so established, and gradually leading to the development of the country to the west, has made and holds Kansas City as a great commercial center.

With the coming of the railroads, the city became the distributing point in the settlement of the country west and southwest, and in turn received the products of those regions, the first of these being largely the range cattle; and so was brought to Kansas City its first distinctive and enormous activity, the meat packing industry. Later it became one of the great grain centers of the country, and today it is practically the center of activities for the oil industry of the mid-continent country.

With this fuel, with the potential water powers of the Missouri River, and with abundant coal easy of access, Kansas City is rapidly creating industries for which great areas of the city's metropolitan district will be necessary. Its development and steady, rapid growth call at this period for a most careful survey and definite city planning in order that no great public or private investments be made along lines that will later need to be changed because of the absence of a thorough understanding of present and future conditions.

Kansas City's park system, which of course, includes its parkways and boulevards, is the result of a careful survey made in 1892, of its needs at the time, and in anticipation of a reasonable growth.

The street system was unconsciously planned through the application of the congressional survey to an exceedingly difficult topography. The sectionizing of western Missouri

VIEW ON KARNES BOULEVARD, KANSAS CITY, MISSOURI.

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[*] Paper presented at the Ninth National Conference on City Planning, Kansas City, Mo., May 7-9, 1917.

[†] Consulting Landscape Architect, St. Louis, Mo.

very naturally led to subdivision of the mile sections into quarter sections, 40 acres, 20 acres and less, and the further subdivision of these tracts into building lots. The result was a gridiron system developed by each separate landholder, and almost universally meant a block of ground 660 ft. from center to center of streets in a north and south direction and 330 ft. in an east and west direction; all this practically regardless of the hills and hollows intervening.

The successful development, so far as it has been accomplished, of the park system with its boulevards and parkways, was outlined by a Board of Park Commissioners under the leadership of Mr. August R. Meyer, its president. In its initial report, issued in 1893, the board in effect, presented the beginning of a city plan. In that report the board said:

> With us an erratic and tantalizing topography has discouraged the adoption of a plan adapted to natural conditions and from which the best results would have been obtainable. Fifteen or twenty years ago (this would have been in 1873 to 1878) a plan might have been adopted that would have made this one of the most beautiful cities in the world. That plan would have involved withdrawing from private use and reserving for the use of the public many of the ravines and bluffs that are but poorly suited for private improvement but which, if improved and maintained as public reservations, would not only have laid the foundation for a magnificent park system, but would thereby have vastly increased the value of adjoining land. It is by no means too much to say that had such a policy been pursued, the assessed valuation of lands within the limits of the city would today be far greater than it is. The difficulty at that time, however, was that such a policy could not be fully appreciated, because Kansas City was not then what she is now, and did not then promise the future that we all now believe is in store for her; and the adoption of such a policy would have seemed to involve heavy burdens upon the then smaller community. * * *
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> The healthful effect upon mind and body of rural surroundings and of beautiful, natural scenery is evident. To provide these for people living in crowded cities is an imperative necessity, well recognized by all who are familiar with the consequences of the continually growing tendency toward concentration of population in cities. That this concentration of population is bound to go on indefinitely must also be admitted. * * *
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> It is to the interest of the city, and of every individual within it, that all lands within the limits of the city be as fully and advantageously occupied as possible and thereby become as valuable as possible. These results can be achieved only if lands are occupied and used for the purposes to which they are naturally and, therefore, best adapted, and if city improvements be so planned and carried out as to justify and encourage the fullest use and the highest possible development and improvement of all lands. * * *
>
> It would be difficult to find anywhere a locality that can rival the topographical eccentricities of the site of our city. Broadly speaking, the site of Kansas City consists of a plateau of a rolling undulated surface that rises boldly to a considerable elevation from four deep valleys; The Missouri Valley on the north, the Kaw Valley on the west, the Brush Creek Valley on the south and the Blue Valley on the east. Below the bluffs in the west bottoms, and again far below the bluffs to the north in the east bottom, and to a lesser extent in the O. K. Creek valley, are located the railroads and freight houses and obtain the facilities for manufacturing establishments and for heavy wholesale houses, and by far the greater amount of this business, although of enormous proportions, never sees the residence and retail business sections. This state of affairs must add immensely to the value of the city as a residence city. High above on the bluffs of the west, north and south sides, are situated the lands suitable for residence purposes, absolutely secure from the encroachment of railroads and manufacturing establishments. * * *
>
> Our better residences are largely planted in groups or colonies on certain sightly streets and in particularly charming localities; but these colonies have not spread out and have not grown together. Between them and around them there exists much land utilized for small residences, small stores and miscellaneous purposes. This is no doubt due to a considerable extent, and especially so on the south side, to the irregular topography of our city; but it is also due to the absence of any distinctive street development and construction which would tie the sightly localities together and make them one.

So Mr. Meyer and his associates on the first Board of Park Commissioners conceived at the very inception of this development the distinctive idea of the city plan. The members of that board and its successors were charged with the development of a park system, not with the development of a general city plan. The results, however, of its efforts, carried forward from year to year by all succeeding boards, have in fact been what the city plans of today are in large measure attempting to effect.

The real planning for the city as a whole was accomplished through the establishment and excellent maintenance of its parkways and boulevards.

As pointed out in the original report, recommending the foundation for this present system—recommending an exceedingly modest, original plan—it was expected that through these lines of communication the widely separated sections, in distance and in rugged topography, would be united in a homogeneous whole, and that the uses of the lands of Kansas City would classify themselves as a result of these lines of communication.

As a matter of course, the bold outlines of the city's general topography have made it possible to realize the board's early expectations, and to hold, in a general way, the principal activities within their rational boundaries. Very naturally, the valley lands of Kansas City proper and its metropolitan district were occupied, and have continued to be so, first by activities incident to water transportation, then by steam railroads, and clustering about these the heavy industries and warehouse districts. The uplands, which rise as high as 275 ft. above the river levels, have therefore remained exclusively for commercial and residential uses.

Kansas City's commercial area, particularly its retail business district, lies upon the hills in the extreme northwestern corner of the city. As the city expands, however, in all its activities, this proves to be and doubtless will remain the geographical center of the city's metropolitan district, which includes the population in the states of both Missouri and Kansas.

While the gridiron street system which prevails does not readily lend itself to a picturesque driveway system, and no serious attempt has been made to deviate therefrom in the formal boulevards, yet the great north and south parkways have sufficient change in alignment and gradient to largely obliterate the impression of formal lines.

The boulevard system has aided in preventing, through the expansion of ample, stable residence areas, the establishment of concentrated dwelling house barracks which usually follow a rapid accretion of population. Kansas City has, therefore, in an unusual degree, great areas of residence sections uniformly built upon and of uniform character wherein there is little likelihood of change, and so has accomplished one great purpose in any rational city planning or replanning, namely, the establishing and holding of the character and value of home places.

Through the expansion of the city by means of boulevards and parkways, together with the street railway transportation system, over great areas away from the business district, it has been possible for the people to get their homes at reasonable prices and without fear of encroachment of antagonistic activities in those residence areas.

Together with its excellent street railway system, the boulevard system has made Kansas City, in effect, a great garden city. It has become almost entirely a home owners' community, made up of individual homes surrounded by their gardens, and in all sections penetrated by the boulevards. The influence of the building and fine maintenance of these highways has resulted in a response in similar care on adjoining and intersecting streets and upon all the homes in those districts.

Where it has been possible, the parkways have occupied the valley lands, which largely coincided with the directions of thoroughfare necessities in those localities; and through the absorption of these low-lying lands, the lands above have been safeguarded against intrusion of private improvements of lesser value.

In its principal result, the parkway and boulevard system has made Kansas City a "good place to live in," and this was the slogan of the civic bodies and of the Commercial Club in their constant support of this movement.

Incidentally, and in less pronounced form, it has affected many other elements of conscious city planning. In its development of means of egress and ingress to the commercial area of the city, the boulevard system has greatly added in classifying and facilitating the vehicular traffic on its streets and has aided in holding the commercial area without serious shifting. The parks and playgrounds, in so far as they have been improved and made use of, are serving the normal recreational needs of the community as one important element in city planning.

As a result of the beginning of the construction of the boulevards, Kansas City accomplished an unusual thing in its street tree planting. The city has practically been turned into one great park by the planting of avenue trees on comparatively wide parking spaces, and as these trees are of uniform character and kinds and are planted on practically all of the residence streets, the city, as seen from above, in the summer months seems embowered in foliage.

The first board's original report in 1893 deplores a twenty years' delay in undertaking a city plan and in acquiring the then characteristically beautiful park lands; yet the community has acquired some of those original important areas which are of great scenic value.

Again this report says: "In what then shall we find the originating impulse, the aim and justification of the park movement? Considering that it has occurred simultaneously with a great enlargement of towns and development of urban habits, is it not reasonable to regard it as a self-preserving instinct of civilization?"

And so an early incentive for the acquisition of parks in Kansas City was this self-preserving instinct; the fear of repulsion of population, since the railway approach to Kansas City was perhaps the most uninviting of any city in the United States. The result was the acquisition of the lands of the western bluffs, the limestone cliffs rising above the then Union Passenger Station at 10th St. and Union Ave. The removal of that station from its old and inadequate site to a position south of the commercial area of the city, has not lessened the value of these western cliffs for thoroughfare, recreation and embellishment purposes. From the driveway there, known as Kersey Coates Terrace, in commemoration of one of Kansas City's early practical dreamers, there is revealed the heart of Kansas City's industries; the great live stock, milling, warehouse and industrial territory, clustered in the valley of the Kaw and Missouri Rivers, and presenting a picture of ever varying interest.

The position of the new Union Passenger Station and the consequent shifting of certain traffic emphasized the necessity for traffic highways, an element in city planning to which, until now, Kansas City has given little coordinate consideration. Not always do cities really require the radical dreams of diagonal lines, sometimes insisted on in theory; and least of all would that sort of development properly apply to so rugged a city as Kansas City when its topographical eccentricities are understood.

The growth of the city must necessarily be chiefly toward the east and south. Its first general impulse was toward the east; its later and principal movement was toward the south. On the east, the valley of the Blue River will doubtless check a great expansion in that direction until provision is made for safe and comfortable means of crossing the railroads and the industrial section. The valley itself is a present and potential heavy industrial area, but the city proposes at the earliest time to occupy the lands on both shores of the stream. The high lands on both sides of the valley are being absorbed for dwelling house purposes as the industries there increase.

Gillham Road.

Armour Boulevard.

RESIDENCE STREETS IN THE KANSAS CITY PARK SYSTEM.

In the acquitition of public lands in this valley the several principal factors in the city plan are being solved; namely, the thoroughfare problem, the drainage problem, and that of recreation and embellishment.

As a thoroughfare, the valley of the Blue River becomes at present the easterly connection in the parkway system around the entire city. In the lower reaches, near its mouth at the Missouri River, harbors and some water transportation problems will find solution, and the Blue now offers, and will later supply in still greater measure, opportunity for water sports which the Missouri and Kansas Rivers do not safely afford.

Toward the west, the state line is no longer the distinct barrier to the expansion of the city's growth. The gradual consolidation of Kansas City, Kansas, and its neighboring towns west of the state line, is rapidly making the two cities a homogenous whole. Means of street communication between the two cities on each side of the state line, with the valley of the Kaw River and the railroad area intervening, is not sufficiently accomplished. With the complete understanding of the requirements, however, on the part of the officers of both city governments, highways are being developed which will closely unite both communities and further tend to hold stable conditions in both cities.

To the south, the city's growth will not be checked, since after 30 years' effort the O. K. Creek Valley, which is occupied by the Terminal Railway in one of its principal approaches to the city, has been spanned on a sufficient number of streets to palliate this barrier.

Still further to the south lies Brush Creek, another valley which the park system is gradually absorbing and which thereby will not interfere with the flow of travel and expansion of growth in that direction.

Like other communities, Kansas City is beginning to appreciate the need of defining by law the uses of lands and preventing the destruction of values through the encroachment of unnecessary, antagonistic activities in given sections.

At present there is no building line anywhere, there is no restriction except on the general lines of public safety. Kansas City has done nothing, through public authority, to safeguard the people in the use of lands for given purposes against intrusion; there is no zoning, no restriction or protection of any kind except that afforded by the boulevards, which have reasonably safeguarded the residential districts of the several kinds. But as the city grows, the foundation heretofore laid in assuring proper and comfortable housing to the population must be secured through protection in zoning laws that will hold within reasonable limits the results so far obtained.

A refreshing contrast to the city's negligence in this sense is the private enterprise in several small sections of the city, more pronouncedly, however, in the County Club and Mission Hills districts. In that large area, self-imposed protective measures have been established against encroachments that would otherwise ultimately alter its character.

The relation of the Kansas City park system to the purposes for which a city plan is supposed to be developed is direct, and, in its results, pronouncedly evident. The parkways and boulevards pierce practically every section of the city, commercial, residential, and to some extent industrial. They therefore make communication between the different sections of the city direct and distinctive.

The boulevards, however, which are in fact nothing more than wide, fine streets, give to the occupants of adjacent private lands reasonable assurance of stable conditions, and in uniting all the great residential sections, give opportunity in the areas which they serve for the development of individual home sites.

The occupancy of large areas solely for residential purposes, except where they are interspersed with local commercial areas, has directly, sometimes unconsciously, discouraged the intrusion of industrial developments within those sections. The effect of the whole has been to hold definitely the unbroken high lands for residential, and the principal valley lands for transportation and industrial uses, confirming in its results Mr. Meyer's expectations from this, in fact, early city plan.

The park lands have by no means been improved in their full possibilities, the foundation work alone having so far been accomplished; yet, Kansas City's public responds promptly and generously to the essential development of this system and through this has established a paying investment in every sense of the word.

Throughout the city local recreation grounds quickly follow the population, and while they are not yet fully supplying present and future needs, the greater areas of properties needed for these purposes have been acquired.

There are at present in use 48 mi. of boulevard and parkway roadways and 31 mi. of undeveloped roadways. A large part of these have private property fronting on both sides, consequently offering approximately 140 mi. of ground frontage as a choice for residence use. The large frontage along such lines of assured value for all classes of residential use has made it possible for the homeseeker to obtain ground at reasonable cost, and has prevented the establishment of excessively high values in residential properties anywhere in Kansas City.

Finally, in sharp contrast to the feeling of sectionalism and consequent antagonism of one section to another within a city existing in some communities, the boulevards and parkways of Kansas City have accomplished the real purpose outlined by Mr. Meyer in the first report, namely, the tying together of all sections and the uniting of Kansas City as a whole into a community whose purposes and actions are for the benefit of the city as a whole at all times.

Extensive Improvements in Fulton County, Georgia

The repaving of Peachtree Road from the city limits of Atlanta to Buckhead is one of the important improvements that have been decided upon by the County Public Works Committee of Fulton County, Georgia. Other paving included in the program is that of Gordon Road, Ashby St. between Murphy Ave. and Deckner Ave., and of walks in the Southeastern Fair grounds at Lakewood. It is said that the poor condition of the thoroughfares and their importance to traffic necessitates their improvement. The plan involves the expenditure of $150,000.

Inspection Tour by New Jersey County Engineers

The New Jersey Association of County Engineers recently made a two-day tour over the roads of southern New Jersey.

One day, according to report, was devoted to Gloucester and Salem Counties. In the former, the party went over the only patrolled road in the state, which is repaired at an annual cost of $60 a mi. After luncheon at the Salem Country Club the gravel roads of Salem County that have been built by county and state prisoners were inspected. The tour included the shore boulevards of Atlantic and Cape May Counties.

Road Legislation in Arizona

By the passage of Senate Bill No. 101, at the last session of the Legislature, the State of Arizona placed itself in line for receiving its portion of federal appropriations made to the various states for road construction and for other purposes. The act vests the State Engineer, with the approval of the State Board of Control, with authority to proceed under the requirements of the federal law in the making of contracts and agreements with the Government in relation to highway survey and construction, and to do whatever is necessary to comply with its provisions.

From a running appropriation of $250,000 annually, the Legislature also provided for a one-mill levy, which will raise in round numbers $600,000 the next fiscal year, 1917-1918. In addition to this the automobile license fund will amount to approximately $125,000, the special bridge appropriations to $150,000, prison labor, $65,000, and federal aid, $140,000, making a total of something over $1,000,000 for highway improvement in the state.

The Effect of the War Upon 1917 Road Work—I.

During the weeks since the United States entered the European war there has been much discussion as to the probable effect that this country's participation would have upon road work in the various states during the present road building season. In order to determine as closely as possible the extent, if any, to which road work is to be retarded by war conditions, "Good Roads" has made inquiry of the chief road officials in the several states, and presents herewith the substance of part of the reports received up to the time of going to press. Other reports will be presented in a later issue.

It should be noted that these reports cover the ground as accurately as it is possible to cover it at the present time. In practically all cases they are from the chief executive of the state highway department of the state in question. The available space does not permit the publication of all the replies in full, and it has been found necessary to abridge many of the replies received to the letter of inquiry which was sent out. In other cases the brevity of the reports permits use in full, and in these cases the letters are quoted verbatim.

Alabama

State Highway Engineer W. S. Keller, of Alabama, reports that the war "has already affected road construction in Alabama, causing a scarcity of labor, which, with the high price of food, has caused an increase in the unit prices of work."

There will be available to the counties in the form of state aid in 1917, according to Mr. Keller, the sum of $288,840.12, all of which will be used for new work. The appropriation is approximately the same this year as it was last year, but the bulk of the work in the state is done by the counties, and figures on the amount of work they will undertake this year are not at hand.

Connecticut

The expenditures for 1917, according to State Highway Commission C. J. Bennett, will total approximately $2,000,000, about one-quarter of which will be used for new work, and three-quarters for maintenance.

Commissioner Bennett reports on the effect of the war as follows:

"The expenditures for this department are approximately the same as in 1916. Any effect which the war may have on the construction of roads in this state will not be felt until after October 1, 1917, as at that time the new appropriations will go into effect."

Georgia

T. E. Patterson, chairman of the Georgia Highway Department, reports as follows:

"We do not think that the war will have any effect on the road work in our state. Practically all of our work is reconstruction and maintenance rather than construction."

Idaho

Approximately $500,000 of state funds is available for expenditure by the Highway Department of Idaho during 1917. It is probable that about $250,000 of this will be used for construction.

State Highway Engineer E. M. Booth adds the following:

"We expect to expend considerably more money this year in road construction than in 1916, as the department was practically without funds last year to carry on any new work."

Illinois

Chief State Highway Engineer W. W. Marr reports that, while the appropriations for this year have not been made, the department expects to have $1,000,000 annually from state funds for use in the construction of state aid roads. This must be met by an equal amount from the counties. There is also available $663,000 from federal funds for the construction of federal aid roads. This also has to be met by an equal amount from the state. Practically all of the money is to be used for new work, the expenditures for maintenance amounting possibly to $15,000 or $20,000.

"The proposed expenditures for the next biennium," according to Mr. Marr, "are practically the same as for the last, except that the federal aid money is in addition."

Iowa

Funds available for road and bridge work in Iowa during 1917 are as follows:

County road and bridge funds	$7,000,000
State automobile license fund	1,500,000
Township road funds	3,365,000
Federal aid (to July 1, 1918)	438.000

It is estimated that 60% of the bridge fund will be used for new permanent bridges and culverts and 20% for the construction of temporary bridges and culverts; that 50% of the county road funds will be used for new work and that 25% of the township road funds will be used for permanent work.

Referring to the effect of the war upon work, Chief Engineer Thomas H. MacDonald of the State Highway Commission reports as follows:

"The State Highway Commission is urging the counties to curtail, in so far as possible, their expenditures this year on account of the high prices and the scarcity of labor. For instance, the price of grading contracts has jumped from about 21 to 23 ct. early in the season to 30 and 35 ct. per cu. yd. at this time. There have been several lettings held recently at which no bids have been received.

"The same relatively high prices prevail for bridge work. The Highway Commission is, therefore, urging curtailment of new work and the establishment of patrol systems to maintain our roads in the best possible condition for service during the present period. Fortunately, since 1913 the state has built a very large number of permanent bridges and culverts during the time that low prices prevailed, and we are now in a position to curtail a considerable percentage of our bridge building without affecting the serviceability of our roads. On the other hand, we have only a small percentage of surfaced roads in the state, and in order to meet the demands which are being made upon agricultural Iowa during the present emergency, the commission believes it to be its duty first of all, to maintain the roads in a more systematic way than has ever been attempted before, and the commission has adopted a conservative policy toward new construction and has instituted an active campaign looking toward the more systematic maintenance of all of our roads."

Kentucky

Commissioner Rodman Wiley of the Kentucky Department of Public Roads reports that the department will have about $1,100,000 to expend in the construction and reconstruction of roads, but that at present it is impossible to say how much of this will be used for new work. The state road fund for 1916 was about $712,000, the increase this year of about $400,000 being due to an increase in the automobile license fund, a slight increase in the valuation of property in the state and to the fact that a few counties last year applied for state aid which was not used, but turned back into the road fund.

Commissioner Wiley reports on the effect of the war in part as follows:

"The war seems to have had very little effect upon road work in this state except in the cost of construction. This cost is increasing so rapidly that I believe it will be only a question of time when we will have to abandon road construction and devote our time to the maintenance of roads which we have built. I anticipate some trouble as soon as the draft bill goes into effect in obtaining inspectors. As a rule, inspectors in this state will come within the age limit of this measure and many of them will probably have to report to the army."

Maine

Chief Engineer Paul D. Sargent, of the State Highway Commission, reports that the funds available for 1917 work are as follows:

State highway construction	$600,000
State aid road construction	300,000
State aid for bridge work	100,000
City and town funds for state aid road work	300,000
Town and county funds for bridge work	400,000
Special legislative resolves for road work	145,000

Practically all of the above amounts are to be used in new work.

Mr. Sargent reports on the general situation as follows:

"The proposed expenditures for this year are a little larger than those for last year; the state aid for bridges is a new proposition entirely. We may not get as much construction done as we have been in the habit of doing, on account of the scarcity of labor and what work we do will cost more on account of the increased prices of labor and materials."

Michigan

State Highway Commissioner Frank F. Rogers reports on the situation in Michigan as follows:

"The entrance of the United States into the present war will probably have no material effect upon road work in this state during the coming season. It will undoubtedly affect the building of some roads, but we cannot say at present that any great effect will be noticeable, in so far as the suspension of work is concerned.

"The state funds available for road and bridge work during the fiscal year from July 1, 1917, to June 30, 1918, will amount to about $2,000,000."

New Hampshire

According to Commissioner F. E. Everett, of the New Hampshire Highway Department, the total amount of state money available for road work this year is somewhat larger than the amount available in 1916. Trunk line construction will amount to $200,000, state aid construction and administration to about $125,000, and maintenance to at least $350,000, the latter being revenue from automobile licenses and therefore not known exactly at present. Commissioner Everett adds:

"We will, however, be unable to accomplish anywhere near as much work as during the previous two years and this is due to labor conditions. We have advised all of our state aid towns not to do any construction work until after the haying season, in order to have all the men and teams available for farm work that is possible."

New Mexico

Assistant State Highway Engineer L. J. Charles of the New Mexico Highway Commission reports as follows:

"The new highway law in this state went into effect March 9, 1917, and the new organization is just being completed.

"Under the new law New Mexico will spend more money on roads this year than during any other period in its history, but the major expenditure will be on roads of possible military importance.

"The total state funds available will be about $301,000. Of this amount $60,000, or 20%, is set aside by law for maintenance.

"Under the cooperative county, state and federal plan the total funds available during 1917 will be about $538,000, of which approximately $120,000 will be for maintenance, and the remainder, after providing for outstanding bond issues, expenses of the commission, etc., will leave about $300,000 for new construction."

At a meeting of the highway commission on April 21 a resolution was passed to the effect that in view of the threatened shortage of foodstuffs and the necessity for the energies of the people being exerted to the fullest extent in the production of grain and other crops, the road work, except emergency work, should be temporarily suspended during the planting season and that the equipment and facilities of the commission should be utilized as far as possible to assist in preparing the ground and planting crops. This resolution, it will be noted, provides merely for a temporary suspension.

New Jersey

R. A. Meeker, State Highway Engineer of New Jersey, reports that "the expenditures to be made this year will not be reduced on account of the war."

State road and bridge funds for 1917 amount to $2,000,000, of which $500,000 is set aside for new construction and the remainder designated for maintenance work. The amount to be used for maintenance will necessitate the expenditure of an equal amount by the several counties, among which it is divided.

Oregon

State Highway Engineer Herbert Nunn reports that "there has been no noticeable effect thus far:"

The people of the state at an election on June 4 will vote on issuing road bonds to the amount of $6,000,000. Mr. Nunn calls attention to the fact that the state has few permanent roads aside from the Columbia River Highway, which is not paved to the coast, and states that one of the strong arguments used for the bond issue is the need of a highway along the coast, paved for the heaviest traffic, to be used as a military highway for coast defense. The same argument, he states, is being used for the improvement of interior roads.

The last legislature provided about $450,000 for road purposes, and this, with the funds alloted to Oregon by the federal aid road act, will give approximately $1,000,000 for use this year whether the bond issue carries or not. If the bond issues does carry this amount will be increased by $1,000,000. In addition, according to Mr. Nunn, two counties will vote on $700,000 in bonds for road work and two counties which voted bonds last year will add $450,000 more. Aside from this, each county is doing its usual amount of road work, the total of which is estimated to amount to about $5,000,000 or $6,000,000 annually.

Mr. Nunn comments on the general situation in his state in part as follows:

"The indirect influence that the war has had on activities in Oregon is that the lumber industry and ship building has been revived and is being operated at a tremendous pace. Farm products, of which Oregon supplies a large quantity, are bringing an unheard of price, and these things have all had their bearing on the general activities of the state.

"The road question is considered by all progressive people as the most important before the state at this time and it is hoped that if this bond issue is carried, it may be expended in such a judicious manner that those who do not see the value may soon realize the value in up-to-date road construction."

Vermont

According to advices from the office of the State Highway Commissioner of Vermont, the proposed expenditures for 1917 are about the same as usual, although it is expected that the work may be somewhat curtailed because of the scarcity of labor. There is available about $600,000 of state funds for road work. Of this amount, about $260,000 will be spent for construction and administration and about $340,000 for maintenance. In addition there will be available $25,000 for state aid on approved bridges on state roads.

Wyoming

State Highway Engineer Z. E. Sevison of Wyoming reports that the department is already noticing some effect of the war upon road construction. "There is a serious shortage of labor," he reports, "and a great many contractors have gone to farming." The state funds for road purposes will amount to about $60,000 and the county funds which will be used on state highway work will amount to $120,000 additional. All of these funds will be used for new work and the amount is about 20% more than was expended in 1916.

New and Amended Road Laws of Montana

Laws enacted by the 1917 legislature of Montana contain provisions for the classification of public roads and their improvement, the establishment of a state highway commission and a state highway fund, the acceptance of federal aid, the disposition of funds collected under motor vehicle regulations, and other matters.

The object of the highway commission law is to secure a uniform system and improvement of highways throughout the state and to obtain the benefits of federal aid. By the act the state is divided into twelve highway districts comprising the following counties

(1) Lincoln, Flathead, Sanders; (2) Mineral, Missoula, Ravelli; (3) Beaverhead, Madison, Gallatin; (4) Silver Bow, Deer Lodge, Granite; (5) Lewis and Clark, Broadwater, Powell, Jefferson; (6) Cascade, Musselshell, Meagher, Fergus; (7) Chouteau, Teton, Hill, Toole; (8) Blaine, Sheridan, Valley, Phillips; (9) Carbon, Stillwater, Sweet Grass, Park; (10) Rosebud, Yellowstone, Big Horn; (11) Custer, Prairie, Fallon; (12) Wibaux, Dawson and Richland.

The state highway commission consists of twelve members appointed by the governor, one from each of the districts named above. After the first appointments the term of office of each member is 4 years. Of the present commission, three members were appointed for 1-year terms, three for 2-year terms, three for 3-year terms, and three for 4-year terms. Vacancies are filled for unexpired terms.

Not more than six members may be of the same political party at one time. The office is non-salaried, but actual expenses incurred in connection with the duties of the commission are allowed. The dates of the regular meetings of the commission are the first Mondays in November and May of each year.

The state highway commission is required to meet on the first Monday of May in each odd year for the purpose of selecting from their number an executive committee of three members, one of whom is designated as president of both the commission and the executive committee.

The time and place of meeting of the executive committee is the first Monday in each month at its headquarters in the state capitol, Helena, but it may meet upon call of the president at any place in the state. The members of the executive committee receive $8 a day and necessary expenses when acting in an official capacity.

Concerning the powers and duties of the commission, the law says:

> (a) The state highway commission shall have power and it shall be its duty to formulate all rules and regulations necessary for the government of the state highway commission and the executive committee, and the said state highway commission is hereby authorized, in its discretion, to make all rules necessary to comply with the provisions of the federal aid road act of Congress, approved July 11, 1916 (39 Stat. L 355) and to obtain for the State of Montana the full benefit of the said act of Congress.
>
> (b) The state highway commission is hereby authorized to designate what public roads in the state shall be classed as state highways and subject to improvement under the provisions of this act and under the provisions of the said federal aid road act of Congress; and the state highway commission shall also formulate necessary rules and regulations for the construction, repair and maintenance of state highways and may provide for local supervision in such cases.

The powers and duties of the executive committee are defined as follows:

> (a) The executive committee is hereby authorized and directed to formulate such rules as it may deem necessary to carry out the provisions of this act, not inconsistent with the rules adopted by the state highway commission.
>
> (b) The executive committee shall employ such engineers, assistants and office help as it shall deem necessary, and the compensation for all such employees and assistants shall be determined by the executive committee and paid out of the state highway fund in the same manner as other state employees are paid.
>
> (c) The executive committee shall keep a record of all proceedings and official acts of the committee and of the state highway commission, and shall file and safely keep all maps and papers belonging to the state highway commission. It shall be the duty of the said executive committee and their assistants and employees to give such advice, assistance and supervision with regard to road construction, improvements and maintenance through the state as time and conditions will permit and as the rules and regulations of the commission may prescribe.
>
> (d) A majority of the executive committee shall constitute a quorum for the transaction of business, and such majority is empowered to act on all matters pertaining to the duties of the executive committee.

The executive committee has jurisdiction over the letting of all contracts for state highway work. If the estimated cost of the proposed work exceeds $1,000, the contract must be let by competitive bidding under the terms and regulations prescribed by the committee and upon the properly executed bond of the contractor. The above does not apply to convict labor on the roads.

Authority is vested in the state highway commission to accept federal aid and to "enter into all contracts and agreements with the United States government relating to the survey, construction and maintenance of roads under the provisions of act of Congress," and to do whatever is necessary to cooperate with the Secretary of Agriculture and provide funds to meet the appropriations made by the government to the state.

A state highway fund, for the purpose of carrying out the provisions of the federal aid road law, is created in the following manner:

> All moneys in the hands of any state officer March 1, 1917, credited to the state highway fund, shall be turned over to the state treasurer to be credited to the state highway fund as created by this act. The secretary of state shall make a monthly report to the state treasurer and to the executive committee of any and all moneys collected by him for licenses for motor vehicles and transmit with such report to the state treasurer 75% of all moneys so received by him to be credited by the state treasurer to the state highway fund, and the secretary of state shall transmit to the county treasurers of the several counties of the state 25% of the amount received by him from residents of each of the several counties for such licenses, which amount shall be credited by the county treasurer to the general road fund of the county. Two-thirds of the amount thus credited to the state highway fund by the state treasurer shall be expended by the executive committee in carrying out the provisions of this act; the remaining one-third of the amount so credited to the state highway fund by the state treasurer shall be apportioned among the several counties of the state by the state highway commission in accordance with such rules as shall be adopted by the state highway commission, to be credited by the county treasurer to the general road fund of the county. This ap-

> portionment shall be made by the state highway commission at their regular meetings on the first Monday of May of each year.

Existing contracts or agreements are not affected by the act.

Under the amended law relating to taxation and revenue the board of county commissioners of each county in the state is required to levy in addition to the $2 tax on each male resident between the ages of 21 and 50 years, a general tax of not less than 2 nor more than 5 mills on the dollar upon the taxable property in the county for the purpose of constructing, maintaining and improving the public highways, the proceeds of which shall constitute the general road fund of the county. The provision excludes incorporated cities and towns already provided with a special tax for similar purposes.

When necessary or desirable the board of county commissioners is further authorized to issue coupon bonds in an amount sufficient for the construction or improvement of main or state highways in a county, provided that the amount of such bonds, with all other outstanding indebtedness of the county, does not exceed 5% of the value of the taxable property within such county.

Highway work in counties is under the supervision of the board of county commissioners. They may divide the county into districts and engage a road supervisor for each district. They are required to survey, lay out, construct, work and maintain such highways as are necessary for the convenience of the public, and to abolish those which are not necessary. They are authorized to let by contract the construction, maintenance and improvement of public highways and bridges when the cost of the proposed work exceeds $1,000.

The board of county commissioners is required to make such reports concerning state roads under their supervision as may be requested by the state highway commission.

New legislation relating to highway improvement districts provides that the board of county commissioners may act upon a petition of the owners of two-thirds of the land fronting on a road sought to be constructed or improved, and where it is found that the public interest demands such improvement, the board is empowered "to levy and cause to be collected an assessment upon all lots, tracts and parcels of land specifically benefited by such improvements, laying out or construction, for paying the cost and expense thereof, which assessment shall become a first lien upon all property liable for, prior and superior to all other liens and encumbrances; and to provide for the payment of such assessments either on the immediate payment plan or by installments, and to issue local improvement district bonds and coupons for each installment." The proportional share of the cost of the work which the local improvement district agrees to assume, as stated in the petition, must not be less than 35%, and it may be as much as 75% thereof. The balance is paid by the board of county commissioners from the county road fund, but must not exceed 65% of the entire expense. Contract for the work is let by the local committee of supervisors according to plans and specifications furnished by the county surveyor under whose supervision the work is carried out and who with the committee of supervisors must appoint an inspector, who shall be present at all times during the progress of the work. If special bonds are issued under the provisions of the act, unsold portions may be issued to the contractor in payment for the work. Highways constructed under this act are called "main highways" and are maintained in the same manner that other roads are maintained. The act does not modify laws relating to the building of "common highways" or "state highways," but is intended to render additional aid to the counties and the state in securing road improvement.

An optional district law was created by the 1917 legislature providing for the organization and administration of special road districts in counties. It is intended to secure the proper care, supervision and maintenance of existing public roads under district officers, without in any way interfering with the authority of the board of supervisors and other county officials. It gives no power to the district organization to issue bonds for any purpose, but a tax for general road purposes of not to exceed 2 mills on the dollar of assessed valuation of a special road district may be levied by the board of county commissioners, and if requested by the directors of the special district, it may levy an additional tax not exceeding 5 mills on the dollar of such assessed valuation. Until a tax may be levied and collected, 50% of the regular road and bridge fund collected from a special district must be set aside for the above purposes. Where the estimated cost of repair or construction work on any road or bridge in a special road district is more than $300 per mile per year, the work is a charge upon the county.

The act relating to the use of motor vehicles upon the highways of the state provides a registration fee of $5 for a vehicle, other than a motor truck, of a rated engine capacity not exceeding 23 hp.; $10 for those of 23 hp. and not exceeding 50 hp., and $15 for all such motor vehicles exceeding 50 hp.

Fees for motor trucks are: 1 ton capacity, $5; 1 to 2 tons, $15; 2 to 3 tons, $25; more than 3 tons, $40.

The registration fee for a dealer in motor cars is $50, and for a dealer in vehicles of the motorcycle type, exclusively, $15. A dealer is furnished with duplicate certificates of registration and six sets of number plates, which may be carried or displayed on any motor vehicle owned or controlled by such dealer and operated upon the public highways. The application of motor vehicle revenue is made as follows:

> The registrar of motor vehicles shall first deduct from all fees paid under the provisions of this act, the actual cost of making and mailing all license tags and identification marks; of the remainder of the fees so paid, he shall transmit 25% thereof to the county from which the application of fee came, for deposit to the credit of the general road fund of said county. The remaining 75% he shall transmit to the state treasurer to be deposited to the credit of the state highway fund. Of the fees thus received by the state treasurer for the state highway fund, one-third shall be held for expenditure in the counties from which the fees originated, under the direction of the state highway commission. The registrar of motor vehicles shall furnish monthly statements of fees and their origin, to the state treasurer and the state highway commission.

A chauffeur's annual fee is $2. For the first violation of any provision of the motor vehicle law, a fine not exceeding $100 is fixed.

An act relating to bridges provides that all bridges that are necessary "in any city or town as a part of a main highway in any county leading over a natural stream from one part to another of such county, shall be constructed and maintained by the county at large and be under the direction and control of the board of county commissioners." For its use a railway company must pay into the county bridge fund a sum determined by the board of county commissioners, but not less than one-fourth nor more than one-half the cost of constructing the bridge, and must pay for its maintenance on the same basis. The city or town in which the bridge is located has necessary police power in regulating traffic thereon. The act does not deprive them of powers under existing laws in respect to building and maintaining bridges within their corporate limits.

Another chapter added to the highway laws provides for the granting of good time allowances in addition to the allowance provided by statute for good conduct, to convicts employed on public roads of the state. A rate of 1 ct. per mi. is fixed for the transportation of prisoners and necessary guards conveyed from the state prison to any point in the state for the purposes of road improvement.

GOOD ROADS

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Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

JUNE 2, 1917.

ROAD BUILDING DURING THE WAR

Road building is to have no considerable setback during 1917 because of America's entry into the world war.

The information upon which this conclusion is based is presented elsewhere in this issue, and, as noted there, is taken from direct reports by the chief highway officials of the various states which have been transmitted to "Good Roads" in response to letters of inquiry recently sent out. While reports from all the states have not been received at this writing, the number at hand and their distribution over the country justify a general conclusion.

In a few states there is something of a tendency towards pessimism, but these instances are exceptional. As a rule there is a marked disposition on the part of those in charge of road work to keep that work going. At the same time, there is evidenced a full recognition of existing conditions, and there is confidence of ability to overcome the obstacles raised by these conditions.

This is as it should be. We need roads now as we never needed them before, and even if they do cost us more they are worth more.

Heretofore roads have had a commercial value and a cultural value. They have provided means for the exchange of commodities, the development of natural resources and the movement of the people from place to place. They have brought the people of the cities and the people of the country closer together, and have put the school, the church and the social gathering within reach of the scattered, sometimes almost isolated, inhabitants of the country districts.

In war the roads will continue to fulfill this function. In addition, they will help to conserve our resources, reduce waste, and speed up production; they will make possible many military operations otherwise impossible; it is even conceivable that they will be the deciding factor in winning the war—the supreme task now before us.

And every road built now will be an asset of incalculable value when peace is restored and all the energies of the nation can again be turned to industrial and commercial development and human progress.

THE RAILROADS AND ROAD BUILDING

The attitude of the railroad interests toward road building has been very helpful in the past and it is imperative that it continue so under the conditions obtaining now and likely to obtain for some time to come. Heretofore the railroads have been quick to recognize the necessity of highways as feeders to their lines and have frequently made special rates for the transportation of road building materials and have sometimes provided special facilities. In the present situation they should insist upon the inclusion of road building materials in the classes to be given preference.

As we have pointed out before, there has never been a time in the country's history when road improvement was of greater importance than it is in 1917. There is not an industry that does not have to pay tribute to bad roads nor one that would not be benefited by better roads. Hardly one of the many problems now confronting the nation but could be solved more easily were the roads of the country in better condition. Expenditures for non-essentials, for luxuries, must be curtailed to meet new expenditures in some lines and largely increased expenditures in others, but roads are neither non-essentials nor luxuries. They are essential—essential to commercial development, essential to military successes, and essential to social, intellectual and moral progress.

Difficulties have been experienced recently by shippers of road building materials because of preference given by the railroads to other freight. The order causing this trouble is understood to have been modified as a result of protests, but it is an example of what may be expected unless those in charge of the country's affairs can be made to see not only the necessity for non-interference with road work, but also the wisdom of doing everything possible to further it.

Let there be no embargo, either partial or complete, on road building materials.

UNJUST DISCRIMINATION AGAINST PUBLISHERS

In the not far distant future—the exact time depending upon the amount of log-rolling and the extent to which the national lawmakers see fit to play politics—Congress will take final action upon the pending war revenue bill. In a measure full of clumsy, ill considered provisions there is one particularly unwise, unjust and uncalled for—the proposed heavy increase in second class postage.

The present rate is one cent a pound. The Ways and Means Committee of the House, led by the irrepressible Kitchin, proposed a zone system similar to the parcel post plan, with rates that would increase the mailing costs of the publisher of the average periodical about 420%. Later the committee modified its plan, lowering the rates, but still putting them entirely too high. At the present writing the matter is in the hands of the Senate Finance Committee. The latest proposal, an amendment by Senator Hardwick of Georgia, said to be favored by the Post Office Department, provides for the retention of the present rate of 1 ct. per lb. on "the portion of the publication devoted to reading matter other than advertising" and a sliding scale of increases on the advertising sections. The latter rates, according to the plan, are as follows: Until June 30, 1918, 3 ct. per lb.; July 1, 1918, to June 30, 1919, 6 ct. per lb.; after July 1, 1919, 8 ct. per lb.

Basing the estimate on issues of the size and make-up of this number, this increase would ultimately add something like fifty cents a year to the cost of mailing "Good Roads" to each subscriber. It should be noted that this increased postage on advertising would probably be in addition to a direct tax of 2% on advertising.

The futility and injustice of any such method of raising revenue as that outlined above is evident to every one familiar with the publication of periodicals and should be apparent to any one after a little thought. A publication manifestly can not be sold as other commodities are. It contracts with its subscribers and advertisers in advance at certain definite rates that can not be changed until the expiration of the contracts. While the dealer in provisions, for instance, can day by day meet fluctuations in the cost of conducting his business, by raising or lowering the price, no such avenue is open to the publisher. In addition, the price of everything entering into the making of the periodical has increased as much as, if not more than, the prices have increased in other business.

There is little doubt that the adoption of a scale of postal rates making any such increases as those so far proposed would result in the elimination of a large number of the weaker publications. It is not proposed here to enter into any discussion of the worth of publications of any class, for we believe that the need of technical publications and trade papers, for instance, is too obvious to require argument.

This matter is one which concerns readers and advertisers as well as publishers. Periodicals can not be published at a loss, and when expenses increase beyond a certain point subscription and advertising rates must be advanced.

The publishers of every reputable magazine are quite willing and ready to bear their just portion of the burden imposed upon the business of the country by the war. They are not, however, willing to be driven out of business entirely by the passage of a law which would turn modest profits to losses; nor could the passage of such a bill result in any increase in revenue. On the other hand it would mean a decrease, for the law of itself would destroy the very sources from which it sought to derive revenue.

Road Work in Schenectady County, New York

A considerable amount of road and bridge work is planned in Schenectady County, New York, for the summer and fall, according to advices from the county. The improvement of town highways throughout the county has been started, and operations will steadily extend to other portions of the highway system.

The macadamizing of the Sanitarium Road in Glenville for 2 mi. will begin in June. One mile of the Wolf Hollow Road is also to be improved. The Curry Road in Rotterdam will be completed. The Gallupville-Quaker Street Road in Duanesburg is scheduled for completion, and it is expected that improvements will be made on the Princetown Road in the southern part of the county.

Work will be done on a number of bridges, including the large bridge over the Lishas-Kill on the new county highway in Nishayuna which is being rebuilt.

Road Taxation in New Jersey

A summary of the direct tax plan of financing road work in New Jersey is contained in a pamphlet recently issued by the State Highway Commission. A comparison of the present administration bill providing for a tax levy producing $15,000,000, with the so-called Egan Bill passed at the November election, which proposed to raise a road fund of $7,000,000 by the issue of bonds, indicates that under the former plan the taxpayer will pay 91 ct. per $1,000 of assessed valuation for 5 years, amounting to $4.55. Under the Egan law the tax would have been 36 ct. per $1,000 for a period of 30 years, amounting to $10.80, representing the amount which a property owner would pay in securing the $15,000,000 which it is claimed is necessary to provide a proper road system.

It is claimed for the Edge road bill that the cost of construction will be paid in five years, and that the person benefited will pay for the improvement, whereas under the bond issue plan the debt would remain until it was necessary to provide funds for repairing the roads.

Specifications for Federal Aid Road Work

Standard forms for plans, specifications, estimates and contracts used in federal aid road work have been prepared by the Office of Public Roads of the U. S. Department of Agriculture in conjunction with a committee representing the American Association of State Highway Officials. The committee consisted of Wm. W. Marr, Chief State Highway Engineer of Illinois; A. W. Dean, Chief Engineer, Massachusetts Highway Commission, and Wm. D. Uhler, Chief Engineer, Pennsylvania Highway Department.

After September, 1917, the proposals for federal aid road work made by the states must be submitted in accordance with the standards prescribed by the Secretary of Agriculture. The forms are obtainable from the Office of Public Roads.

Plan for Jamaica Bay Boulevard, New York City

The Board of Estimate and Apportionment of New York City has adopted a plan for the construction of the proposed Jamaica Bay Boulevard, at an estimated cost of $700,000. The Rockaways have agreed to assume one-half of this expense. The plan was endorsed by Chief Engineer Nelson P. Lewis, of the Board, who, it is stated, would assess one-half the total cost as follows: Manhattan, 30%; Brooklyn, 10%, and Queens Borough, 10%. On account of the proposed extension of Flatbush Ave. which would place a burden upon Brooklyn Borough, and the claim that the Jamaica Bay Boulevard would reduce the distance from the borough only 6 mi., the latter objects to paying more than 6% of the $350,000.

It has been proposed that the cost of acquiring Woodhaven Ave., of which Jamaica Bay Boulevard forms a part, be divided on the basis of 60% to all property within 4,000 ft. of the road, 25% to Manhattan, 5% to Brooklyn, and 10% to Queens.

NEWS NOTES

The Waycross Motor Club of Waycross, Ga., is preparing to have all the roads of Ware County marked with uniform signs showing distances to points in the county and other information for travelers.

The Ohio State Highway Department recently let contracts for 54.84 mi. of state aid road construction amounting to $845,776, and for repairing and improving 96 mi. at an estimated cost of $121,990.

Cass County, Michigan, has voted to raise $600,000 by a bond issue for the purpose of constructing an improved road system, the lines of which will come within 1½ mi. of every farmhouse in the county, according to report.

Eau Claire, Wis., is Spending $71,000 on Street Paving, the work being now fully under way. Creosote block on a concrete foundation will be put down on 9th Ave. from Menomonie to Water St., and on Water St. from 9th to 6th Ave.

A Recent Road Bond Election in Adams County, Idaho, resulted in a majority of 10 to 1 in favor of good roads. Of the total amount voted, $100,000, it is reported that $80,000 will be used for the construction of a north and south highway, and the balance for secondary road improvement.

The Counties of Georgia will receive upward of $140,000 from the sale of automobile licenses this year, as against $98,000 distributed to them last year. The money is now available, but its apportionment is being held up by delay on the part of a number of counties in sending in their mileage reports upon which the distribution is based.

MEETINGS

Calendar of Coming Meetings

June 12-14.—New York State Conference of Mayors and Other City Officials—Annual Conference, Buffalo, N. Y. Secretary, W. P. Capes, 25 Washington Ave., Albany, N. Y.

June 20-22.—Texas Good Roads Association.—Midsummer Convention, Mineral Wells, Texas. Secretary, D. E. Colp, San Antonio, Texas.

June 25-27.—League of Louisiana Municipalities.—Annual convention, New Iberia, La. Secretary, Joseph B. Elam, Mansfield, La.

June 26-30.—American Society for Testing Materials—Annual meeting, Atlantic City, N. J. Secretary, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

Conference of Mayors and Other City Officials of the State of New York

The eighth annual Conference of Mayors and Other City Officials of the State of New York will be held in Buffalo, N. Y., on June 12, 13 and 14. The Conference headquarters will be at the Hotel Iroquois. All meetings, except the one on Tuesday evening, June 12, will be held in the Council Chamber of the City Hall. The citizens of Buffalo are invited to attend all sessions in the City Hall, and a program of entertainment for both visiting officials and ladies has been arranged by officials of Buffalo and local committees.

The registration of delegates will begin at 10:30 a. m., Tuesday, at the Hotel Iroquois. The first session will open at 2:30 in the afternoon, Mayor Walter R. Stone, of Syracuse, presiding. Mayor Louis P. Fuhrmann, of Buffalo, will make an address of welcome, to which the President of the Conference, Mayor Burns, of Troy, will respond. Reports of officers and committees will be received, and resolutions introduced. A banquet will be given at the Hotel Iroquois in the evening.

Wednesday forenoon a paper on "Paving Contracts" will be presented by W. Earl Weller, City Engineer of Binghamton, who will be followed by W. Thomas Wooley, City Engineer of Schenectady, on "Street Lighting Districts of Assessment." In the afternoon H. J. Case, Secretary of the New York City Police Department, will give an illustrated talk on "Regulating City Traffic," which will be discussed by other city officials. A number of addresses on important municipal subjects are scheduled for the conference.

PERSONAL NOTES

E. R. Morgan has resigned the office of State Road Engineer of Utah.

M. Galbreath, of the U. S. Office of Public Roads and Rural Engineering, is directing road work in Trigg County, Kentucky, for the State Department of Public Roads.

F. L. Hargett, Assistant Resident Engineer in charge of road improvement at Monroe, La., has been made Superintendent of Roads and Bridges of Bowie County, Texas, with headquarters at Boston, Texas.

Eugene W. Stern, Chief Engineer of the Bureau of Highways, Borough of Manhattan, New York City, has been ordered to duty at the training camp at Fort Oglethorpe, Ga. Mr. Stern's commission as Major in the Engineer Officers' Reserve Corps of the U. S. Army was noted in "Good Roads" for March 3

J. H. Giles has been appointed City Engineer of Pocatello, Idaho.

Albro Gardiner has been appointed City Engineer of Kirkland, Wash.

Ira R. Browning has been appointed State Road Engineer of Utah.

Marvin H. Mooney has been appointed City Engineer of Trenton, Mo.

Christopher Johnson has been appointed City Engineer of Warrensburg, Mo.

R. G. McBride, of Elko, Nevada, has been appointed Assistant Engineer of the state.

O. E. Noble has been appointed Highway Engineer of Riley County, Kansas. He was formerly City Engineer of Manhattan, Kan.

C. H. Knowles, Engineer of the Roadmaster's Department of Multnomah County, Oregon, has been made Assistant Roadmaster, succeeding to the duties of road viewing formerly done by Herbert Nunn, present State Highway Engineer.

NEWS NOTES

One-Hundred Miles of Improved Roads in West Virginia are provided for by the awarding of contracts by the State Roads Bureau approximating $750,000.

The Commissioners of Asheville, N. C., have passed an ordinance authorizing the issue of street improvement bonds amounting to $280,000 for use during the next three years.

The State Highway Department of New Jersey has announced that the construction of new roads in the state will not be approved until it has received assurances that such roads will be properly maintained under a patrol system.

In Erie County, Pennsylvania, an organization has been formed in support of the State Highway Department in the reconstruction of roads in the county extending from the Ohio line to the New York State line along the lake front.

The Board of Freeholders of Essex County, New Jersey has authorized the issue of bonds amounting to $600,000 for road improvement in Essex County. The roads to be improved with the proceeds of the bond issue are: Central Ave., Orange; Little Falls Road, Cedar Grove; Ridgewood Ave., Glen Ridge; Grove St., Irvington; Grove St., Montclair; Upper Mountain Ave., Montclair; Bloomfield Ave., Caldwell; Franklin St., in Belleville and Bloomfield, and Sanford St. in Irvington.

Urging the Movement of Road Materials as a War Measure, resolutions adopted by the Mississippi Railroad Commission and the various boards of county supervisors of Mississippi, have been approved by the State Highway Department and referred to the Director of the U. S. Office of Public Roads and Rural Engineering and to other officials at Washington, with the request that railroads be notified to furnish full equipment for materials required for surfacing highways now under construction. Concerted action on the part of other state highway departments to bring about the above result has also been proposed.

The Pine Mountain Road Committee of the Louisville, Ky., Board of Trade, is conducting a campaign to secure the building of a road over Pine Mountain to the Pine Mountain School Settlement, which is in an isolated section of Harlan County, of that state. It is proposed to raise $10,000 for the purpose from private and business sources. Under the auspices of the above named committee, John Fox, Jr., the well known author, is aiding the project by readings from his book, "Hell for Sartin'," and other stories of mountain life on the Kentucky and Virginia border. The Harlan Commercial Club and other bodies are aiding the movement, and it is reported that more than half the required amount has been subscribed.

EQUIPMENT — TRADE — MATERIALS

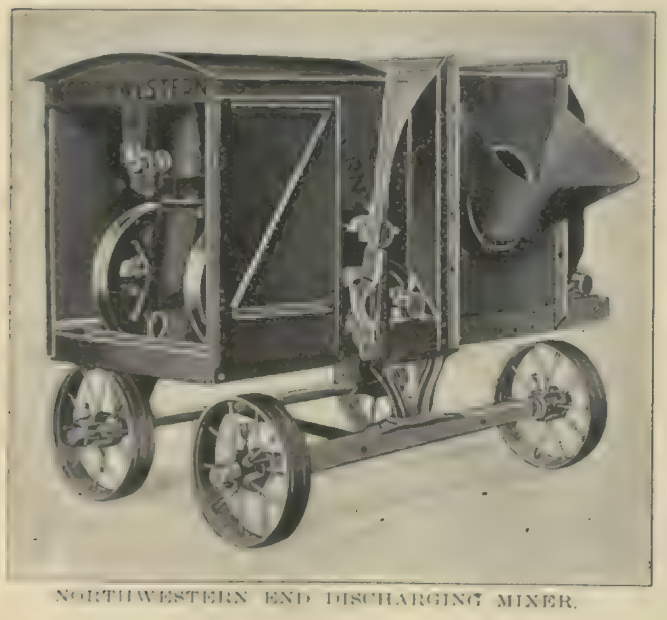
Bucyrus Company Issues House Paper

A four-page house paper devoted to the interests of the Bucyrus Company, of South Milwaukee, Wis., is now published by the company on the 1st and 15th of each month.

The company is one of the largest manufacturers of steam shovels. The paper is intended to promote a closer relationship among employees and to provide the workers in one section of the business with knowledge of what is being done in other departments. The editorial staff consists of Bradlee Van Brunt, Editor; L. A. Morgan, Assistant Editor, and Ray Ilg, Editor of the Evansville section.

New End Discharging Concrete Mixer

A new end discharging concrete mixer that has recently been put on the market is shown in the accompanying illustration.


NORTHWESTERN END DISCHARGING MIXER.

This mixer, while designed primarily for such work as alley paving, the construction of bridge footings and the like, is adapted to various uses where a small, easily handled machine is desired. The mixer is built in two sizes, one of 5 cu. ft. and the other of 10 cu. ft. capacity. The special claim made for the machine is the ease with which it can be handled in close quarters.

The mixer is manufactured by the Northwestern Steel & Iron Works, Eau Claire, Wis.

The "Caterpillar" Trail

A new road to be known as the "Caterpillar" Trail is under construction in Tazewell County, Illinois. The road is to be of gravel, 7 mi. in length and 40 to 60 ft. wide.

Farmers to be benefited by the improvement have furnished gravel and given small strips of land to provide a uniform width for the road and to reduce the number of cuts and fills, but the cost of construction, $40,000, with the exception of $2,000 raised by East Peoria business interests for culverts, is to be borne entirely by the Holt Manufacturing Co., manufacturers of the Caterpillar tractors, several of which will be used on the work.

Ornamental Street Lighting

A booklet under the name of the "Novalux Album," being Bulletin No. 43503 on "The Application of Novalux Units to Ornamental Street Lighting," has been issued by the General Electric Co., of Schenectady, N. Y. The bulletin, which is attractively prepared, contains 36 pages and 49 illustrations, many of them full-page, showing the use of "Novalux" units in various cities throughout the United States. It is intended as a guide in the selection of modern street lighting units.

"Duplex Doings"

The above is the name of an illustrated monthly sheet published by the Duplex Truck Co., of Lansing, Mich. The magazine is issued for the benefit of motor truck users and contains, according to its initial number, a symposium of what is dong among Duplex owners, dealers and builders. Among other items of interest appearing in the May issue is a brief biography of H. M. Lee, President and General Manager of the company.

The Dunn Wire-Cut Lug Brick Co., of Conneaut, Ohio, has tendered the output of the 68 paving brick plants operating under the Dunn licenses to the Government for immediate use in the construction of military roads. The company has also offered the Government free advisory and inspection services by its corps of engineers for the construction of such roads.

A condensed catalog and price list is issued by the Lee Loader & Body Co., of 2343 So. La Salle St., Chicago, Ill. The catalog contains descriptive data and illustrations of the "Lee line" of patented labor saving equipment used for hauling loose material. Several views of Lee loaders are shown, as are also the different types of dump bodies for motor trucks, trailers and wagons, with suggestions as to auxiliary equipment. The dimensions and weights of the machines are given with corresponding prices.

Especially successful use of Duplex trucks in road work is reported from Waterloo, Iowa, and Ingham County, Michigan. At the former place a demonstration was made with one of the trucks in hauling a road leveler that was being shown to the county commissioners. The leveler was equipped with two blades, each 24 ft. long, and unsuccessful efforts to stall the truck by standing on the ends of the leveler blades and shoving them down into the ground were made by the local officials. In Ingham County, two of the machines have been purchased by the road commissioners. According to a statement made by one of the commissioners, the trucks can be operated anywhere that a team can be used, and will replace from 7 to 10 teams on a haul of 5 mi. or more per round trip.

A 2,000-mi. Highway System for the Province of Manitoba, Canada, has been proposed by the Minister of Public Works. The cost of permanently constructing this mileage, which would be composed of the principal highways in the province, is estimated at $4,000 a mi., and would amount in 10 years to $8,000,000.

The Counties of New York State have received their appropriations from the state for the maintenance and repair of highways. The amount, $4,000,000, was distributed on the basis of estimated cost of repairs. An additional $2,000,000 was apportioned to towns on the basis of assessed valuation per mile of highways, not exceeding $25 per mi. except in cases where the assessed valuation was more than $25,000 a mi.

GOOD ROADS

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The Importance of the Cheaper Types of Roads

In the absence of reliable statistics it is impossible to estimate even approximately either the relative amounts of money expended in the building of roads of different kinds or the relative mileages of different kinds. It is certain, however, that a large part of the country's annual expenditure for roads—probably most of it—goes for the building of the simpler types, that is, for earth, gravel, chert, sand-clay, water bound macadam and the like. Because most of the current literature of road making deals with the so-called permanent or "hard-surfaced" roadways this fact is sometimes overlooked.

The importance of bitumens, brick, Portland cement, wood blocks and granite blocks as paving materials can not be over-estimated. The use of these materials in various combinations has made possible the building of roadways capable of carrying the heavy and diversified traffic of today, and they are indispensable to the road builder's art. But their use is necessarily limited to those cases in which the improvement to be made will yield a return commensurate with their cost, and there remains an enormous mileage requiring improvement, but carrying a traffic not sufficient to justify any very great expenditure. In such cases recourse must be had to cheaper materials, which are generally those that can be obtained alongside or not far distant from the road to be built or improved.

STATE AID SAND-CLAY ROAD, GENEVA COUNTY, ALABAMA—OLD ROAD SHOWN AT LEFT.

The water bound macadam road—not so many years ago the standard of high class construction outside of cities and towns—is now generally classed with the cheaper types of roads, especially, as is frequently the case, when suitable stone can be secured in the immediate neighborhood of the work. It is sometimes argued that the day of the water bound macadam has passed, and this is undoubtedly true so far as very heavily traveled main roads are concerned. But for roads of less importance, those carrying a comparatively small amount of traffic, water bound macadam still provides a satisfactory roadway. If given a surface treatment of bituminous material, it can be used for roads of moderately heavy traffic.

The gravel road is of even greater importance because of the wider distribution of the material of which it is built. While there is a very great difference in the road building qualities of gravels, a material that can be used successfully can be found over a very large area of the country, from Maine to Washington and from Minnesota to Louisiana. The road is easily built, and is adequate for a fairly heavy traffic, especially if proper drainage provisions are made. Like the macadam road, it can be given a bituminous surface treatment, and thereby made suitable for heavier traffic.

WATER BOUND MACADAM ROAD, HUNTSVILLE, ALABAMA —FIRST STATE AID ROAD IN ALABAMA.

Sand-clay roads have provided the solution of the road improvement problem in many communities, especially in the South, although their use has by no means been confined to that section. While the materials for its construction, sand and clay, are not always found in close proximity to the road or to each other, both often can be found within practicable hauling distance of the proposed improvement.

In addition to these types of roads there is the ordinary earth road, and others of various types which are of considerable local importance where the materials for their

AN ALABAMA GRADED ROAD.

construction are found. The earth road, when climatic and weather conditions are right, is an excellent road. By means of proper drainage and systematic, continuous maintenance by the drag and otherwise, a road of this kind can be kept in first-class condition and the portion of the year during which it can be used may be materially increased.

An idea of the importance of the macadam road and other cheaper types of roads can be had from an examination of the statistics on road mileages of the several states contained in Bulletin No. 390, U. S. Department of Agriculture, "Public Road Mileage and Revenues in the United States, 1914." According to one of the tables in that publication the total mileage of "surfaced" roads in the country in 1914 was 257,291.54 mi. This total mileage was classified as follows:

Kind of Road	Number of Miles	Percentage of Total
Macadam	64,898.43	25.22
Bituminous macadam	10,499.79	4.08
Gravel	116,058.12	45.11
Sand-clay	44,154.73	17.16
Brick	1,593.88	.62
Concrete	2,348.43	.91
Miscellaneous	17,738.16	6.90

This shows that the three types of roads, macadam, gravel and sand-clay, included in the class under consideration, comprised 87½% of all surfaced roads in 1914. But this

A MASSACHUSETTS GRAVEL ROAD.

does not tell the whole story. In addition to the 257,291.54 mi. of surfaced roads, there were 2,188,470 mi. of unsurfaced roads. As the unsurfaced roads are obviously included in the classes under consideration this means that 100% of the unsurfaced roads and 87½% of the surfaced roads were included. Since the surfaced roads comprised only 10½% of the total mileage, over 98½% of the entire road mileage of the country—outside of cities and towns, of course—consisted of unimproved and improved earth, gravel, sand-clay and similar roads, and macadam roads.

While these figures are all for 1914, it is not likely that the relative mileages have changed by more than 2% at the outside, so that it is safe to say that at present over 95% of the country's total road mileage consists of roads of the cheaper types, and also that by far the major portion of the mileage of improved roads is composed of the cheaper types. The large mileage of such roads built every year also evidences their continued usefulness, and in this connection attention is called to the data in the accompanying mileage tables for different kinds of roads. The states noted are those in which large amounts of work of the kinds shown were done in 1915. The figures are taken from "Good Roads" of July 1, 1916. ["Review of Road Work in the United States During 1915 and Forecast of Work in 1916."] In many cases the figures cover only state or state aid work, and do not include work done by towns, counties and districts.

TABLE SHOWING MILEAGES OF WATER BOUND MACADAM, GRAVEL, SAND-CLAY, AND GRADED ROADS BUILT IN VARIOUS STATES IN 1915.

Water Bound Macadam Roads.

State	Aprx. No. of Mi. Built
Arkansas	80
Florida	75
Kentucky	337
Michigan	142
Ohio	157
Virginia	188
Wisconsin	387

Sand-Clay Roads.

State	Aprx. No. of Mi Built
Alabama	516
Florida	400
Minnesota	144
*Virginia	366

Gravel Roads.

State	Aprx. No. of Mi. Built
Alabama	344
Colorado	107
Iowa	179
Louisiana	125
Maine	191
Maryland	137
Minnesota	498
New Hampshire	132
Vermont	162
Virginia	110
Washington	235
Wisconsin	181

Graded Road.

State	Aprx. No. of Mi Built
Alabama	819
Arkansas	300
Colorado	1,180
Florida	400
Idaho	200
Iowa	462
Kentucky	180
Minnesota	1,997
Montana	1,500
New Mexico	180
North Dakota	4,100
Oklahoma	1,470
Virginia	152
Washington	191
Wisconsin	497

*Sand-clay and "soil."

Siskiyou Highway to Be Paved

The Siskiyou Highway from the summit of Siskiyou Mountain to the California line is to undergo improvement without delay, according to report.

The highway has been graded from a point at the foot of the mountain 7 mi. south of Ashland, to Steinman, a distance of 3 mi., and some macadamizing has been done on the road from Steinman to the top of the mountain. The paved portion of the road is 8 ft. wide, and occupies the inside half of the roadway. It is proposed to lay macadam on the outer half, where macadam does not exist at present. In addition to $65,000 which the state has designated for use on the highway, it is expected that other funds will be appropriated for the purpose.

The Coleman du Pont Road in Delaware was recently turned over to the state. The road is of concrete, 21 mi. in length, and extends from Georgetown to the Maryland state line. It was built at a cost of $11,000 a mile.

Recent Highway Legislation in Maine

Provision for the acceptance of federal aid was made by the passage of an act by the Maine legislature of 1917. Other legislation passed at that session provides for state aid to towns, the protection of travelers on highways at railroad grade crossings, the licensing of automobile buses and trucks, and for various other amendments to the state highway laws.

Legislation relating to grade crossings provides that within six months after the passage of the law the public utilities commission and the state highway commission shall require warning signs to be placed and maintained wherever necessary on all highways within the state, the signs to be placed on each side of such railroad grade crossings and at such distances from them as may be determined by the commissions.

The character and location of the warning signs, and regulations for their operation are specified in Chapter 50 as follows:

> Section 2. Such signs shall consist of a disc 24 in. in diameter, the field thereof to be white with a black border line 1 in. wide, and with black perpendicular and horizontal cross lines 2½ in. wide; the reverse side of such disc to be colored black. In each of the upper quarterings shall appear in black the letter "R," 5 in. high, 3¼ in. wide, lines 1 in. stroke. Such signs shall be placed in conspicuous locations beside the highway at a distance of not less than 300 ft. from the nearest rail of such crossing unless local conditions in the judgment of the two commissions named in Section 1 hereof make it reasonable to cause such sign to be located at a lesser distance from said nearest rail.
>
> Section 3. The person controlling the movement of any self-propelled vehicle upon passing any such warning sign located more than 100 ft. from a grade crossing shall reduce the speed of such vehicle so that within a distance of 100 ft. from the nearest rail of such crossing such vehicle shall not proceed at a greater speed than 10 mi. per hour upon or over such crossing. This provision shall be deemed to require a precaution in addition to those now prescribed by law or otherwise required with reference to the duties of persons on a highway approaching a railroad grade crossing.

The expense of erecting and maintaining the signs is to be borne by the state. For a violation of the foregoing sections a fine of not less than $10 is fixed.

Chapter 145 of the 1917 laws, by Section 1 thereof, requires railroad companies operating within the state to install, operate and maintain an automatic signal at any highway crossing not protected by gate or flagman where the public safety demands such signal as a proper measure of protection. The entire expense connected with the operation of the signals is chargeable to the railroad company. The words "signal" or "automatic signal" used in the act are to be construed as "an appliance which gives warning of the approach of a train and which is audible and visible by day or by night."

Section 2 of the above chapter provides as follows:

> Immediately upon the passage of this act the public utilities commission shall designate by general orders, which may be issued without formal notice or hearing, the grade crossings in this state at which, from all points on the highway or other way within 150 ft. of such crossings and on either side thereof measured along said highway or way a traveler on the way carrying such crossing can have a fair view of an approaching train, engine or car continuously from the time such train, engine or car is 300 ft. from such crossing until it has passed over the same, either under existing conditions or by bushes, trees, fences, signboards or encroachments being trimmed, cut down or removed as hereinafter provided.
>
> Section 3. At every crossing designated under the provisions of the preceding section and at every crossing of a highway or other way and an electric railroad at grade the municipal officers of the towns in which the crossing is located are given authority and are hereby required, when by order directed so to do by the public utilities commission, after 10 days' notice to all persons interested, to remove embankments and other obstructions within highway limits and to enter upon private property and properly trim, cut down or remove bushes, trees, fences, signboards and encroachments which obstruct the view of an engine, train or car by a traveler at or near any such crossing. The authority of the commission in any order and of the municipal officers acting thereunder shall not extend beyond a point 150 ft. on either side of any such crossing measured along the highway or other way or beyond a point 300 ft. on either side of any such crossing measured along the railroad right of way, the purpose herein being to enable a traveler on any such way, when such traveler is 150 ft. or less distant from any such crossing, to have a fair view of an approaching train, engine or car continuously from the time such train, engine or car is 300 ft. from such crossing until it has passed over the same.
>
> Section 4. Within such time as said commission by order directs, such municipal officers shall cause such bushes, trees, fences, signboards or encroachments to be trimmed, cut down or removed, and the expense thereof shall in the first instance be paid by the city, town or plantation wherein the labor is performed, but upon the filing with the governor and council of proper proof of such payment, one half of any such amount shall be repaid by the state to such city, town or plantation, the same to be paid out of any funds not otherwise appropriated.

Reasonable damages resulting from work performed under the foregoing sections may be allowed by the commission and paid by the city, town or plantation, and one-half of the amount charged to the state.

No authority is given for the removal of buildings without the consent of the owner. A fine or imprisonment is imposed for interference with the work referred to in sections 2, 3 and 4.

Further provisions of this chapter are:

> Section 9. Within 60 days after the passage of this act the public utilities commission shall serve upon each steam railroad company operating in this state a list of its grade crossings at which in the opinion of the commission automatic signals should be installed, operated and maintained or some other form of protection given to travelers on the highway or other way, and shall order a date for public hearing thereon at which time the respective railroad companies shall show cause why such protection as suggested by said commission should not be given. Within 30 days after said hearing the commission shall determine and, by order served on the respective railroad companies, shall state the character of protection, if any, to be installed at each such crossing and shall set a date or dates on or before which each such crossing shall require each railroad company to protect one-quarter of said grade crossings during the calendar year 1917, and one-quarter during each of the three succeeding calendar years, giving preference in point of time to the more dangerous crossings, but for good cause shown the commission may suspend any such order or may extend the time within which any railroad company shall comply therewith. If at any such crossing the railroad company passing over the same shall, under existing law, under the provisions of this act or at its own expense, remove obstructions so as to permit a fair view as described in Section 2 hereof, such crossings shall not thereafter, so long as such fair view is maintained, be held to be subject to the provisions of this section.

The public utilities commission has authority to enforce compliance with the provisions of this act. Any steam railroad company subject thereto "may enter upon any private property and remove any embankment or other obstruction except a dwelling house." The owner is entitled to damages estimated and paid for as provided by Chapter 56 of the revised statutes. The act applies to railroads of standard gauge.

A new state aid law is contained in Chapter 154 under which three or more towns traversed by a continuous highway not less than 15 mi. in length may, not later than April 1 of any year, vote an appropriation for the construction of such highway as a state aid road. Where such action is taken the state highway commission is authorized to set apart for the purpose an aggregate sum the component parts of which are determined by it in accordance with the provisions of the state aid law. The amount so set apart together with the sums appropriated by the towns constitute a joint fund for the construction of such through highways under the supervision of the state highway commission. The towns receive no other state aid money during the year.

State aid appropriations to towns—including those provided for in the law embodied in Chapter 154, referred to above—are based upon Section 20 of Chapter 25 of the revised statutes relating to state and state aid highways, which section was amended by Chapter 258 to read in part as follows:

> Section 20. The commission, from the fund for state aid construction provided by this chapter, shall to each town which has conformed to the provisions of Sections 18 and 19, for each dollar so appropriated, apportion the following amounts: To each town having a valuation of $200,000 or less, $2.66 for each dollar appropriated by said town; to each town having a valuation of over $200,000 and not over $1,000,000, $1.33 for each dollar appropriated by said town; to each town having a valuation of over $1,000,000, and not over $1,200,000, $1.22 for each dollar appropriated by said town; to each town having a valuation of over $1,200,000, and not over $1,400,000, $1.13 for each dollar appropriated by said town; to each town having a valuation of over $1,400,000, and not over $1,600,000, $1.07 for each dollar appropriated by said town; and to each town having a valuation of over $1,600,000, $1 for each dollar so appropriated by said town. The money appropriated by towns applying for state aid as hereinbefore provided, with the amount apportioned by the commission as hereinbefore provided, shall constitute a joint fund for the construction and permanent improvement of the state aid highways in such towns.

One of the main features of Chapter 258 containing amendments to the state highway law is the authorization given for a mill tax to provide funds for the construction of state and state aid roads. Section 36, relating to the tax levy, is as follows:

> A tax of one mill on a dollar shall annually be assessed upon all property of the state according to the value thereof, and shall be known as the mill tax highway fund for the construction of state and state aid highways. * * * The proceeds of this tax shall be used wholly for the construction of state and state aid highways. * * * Two hundred thousand dollars of the amount herein named shall be added to the fund of $300,000 for state aid construction as provided in Section 34, Chapter 25 of the revised statutes, and shall be called state aid highway fund. The balance of said mill tax highway fund shall be used exclusively for the construction of state highways as provided. * * * and shall be called state highway fund; except so far as may be necessary to meet the requirements of the national government in order for the state to receive federal aid for highway construction, the state highway fund shall be expended equitably among the several counties of the state by the state highway commission.

This law provides that no portion of the mill tax highway fund shall be expended on a portion of a street devoted exclusively to business or on any street where the houses on each side thereof average less than 20 ft. apart for a distance of ½ mi. in cities or towns of over 2,500 inhabitants.

Section 35 provides that the sum of $500,000 be appropriated for state highway construction during 1917. This includes federal aid but is exclusive of funds received from the reissue of bonds already retired or those to be retired.

A requirement of Chapter 258 is that the state highway commission, whenever practicable, "give preference in employment to the inhabitants of the town in which such highways are located."

A revision of the law relating to motor car registration in neutral zones permits the owner of a motor vehicle who has complied with the laws of his own state and whose residence is within 15 mi. by highway of the border line of such state, to operate his car upon the highways included in a similar area in the State of Maine, if such vehicle is registered by the Secretary of state of Maine, and provided the state from which application is made grants a like privilege to residents of Maine. The fee for this special registration is $2.

Chapter 213 amends certain sections of the revised statutes relating to the operation of motor vehicles, with special reference to speed limitations.

Chapter 234 regulates registration fees for motor vehicles used for the conveyance of persons for hire, pleasure or business, fixing the rate of $5 for a vehicles of 15 hp. or under; $10 each for a vehicle of 15 hp. to 35 hp.; and $15 each for those of more than 35 hp. For motor trucks or automobiles used for commercial purposes, $10; motorcycles, $3; traction engines or log haulers, $10.

Chapter 254 is an act to regulate the operation of motor vehicles for the carriage of passengers and freight. Its provisions are:

> Section 1. The state highway commission may, upon proper application in writing, grant permits for the operation of jitney buses, so called, or anv other steam or motor driven vehicles making regular schedule trips for the carriage of passengers or freight from one point to another, over any street, highway, or bridge, and may make regulations limiting the rate of speed of such vehicles, their weight, the load they may carry, and the time of year during which they may operate, and any other regulations which in the opinion of said commission are necessary for the protection of said streets or highways, and no such jitney bus, or other steam or motor driven vehicles shall be so operated on any highway or town way without such permit.

Fines resulting from damage to a street, highway or bridge are paid into the state treasury to be used for the repair of the road or bridge so damaged.

The law providing for state and county aid in the construction of highway bridges was amended, and by another act provision was made for the use of prison labor in the construction and improvement of highways.

Convict Labor Law Passed by the Rhode Island Legislature

In addition to the act to obtain the benefits of federal aid, noted in "Good Roads" for May 5, a bill allowing the employment of convicts upon state roads was passed by the 1917 legislature of Rhode Island. These laws were the only ones affecting road work in the state enacted at that session. The convict labor law follows:

> Section 1. The penal and charitable commission may, upon the written request of a majority of the members of the state board of public roads, detail such convicts as in their judgment shall seem proper, not exceeding the number specified in said written request, to work upon such of the state roads as shall be designated in said written request, and said state board of public roads is hereby authorized to use and employ all such prisoners as they may deem practicable, in and upon the construction, maintenance, improvement or repair of the state roads; Provided, however, that nothing herein contained shall authorize the letting out by contract or otherwise of the services of any such convicts to any person or firm or corporation except as aforesaid for work upon the state roads.
>
> Section 2. The additional cost of transportation, guarding, supervision and maintenance of such convicts, and a reasonable charge for the services of said convicts when employed upon said state roads, shall be charged to the appropriation out of which the cost of construction, maintenance, improvement or repair of said state roads, as the case may be, is to be paid, and credited to the funds available for the support of the state institutions in Cranston in such manner and upon such basis as shall be agreed upon by said penal and charitable commissions and said state board of public roads.
>
> Section 3. Said penal and charitable commissions are hereby authorized and empowered to adopt rules and regulations providing for the granting of privileges to such convicts as shall be employed on said state roads, and it may, from time to time, pay to the families or dependents of such convicts, or in case they have no dependents, then to the convicts themselves at the end of their respective terms, the whole or any part of the earnings of such convicts remaining after deducting therefrom the cost of transportation, guarding, supervision and maintenance, as aforesaid.
>
> Section 4. Said penal and charitable commission shall make all lawful and necessary rules and regulations for guarding such convicts. Said rules and regulations shall be entered in a book kept for that purpose and a copy thereof given to the warden and other officers of the prison.
>
> Section 5. This act shall take effect from and after its passage and all acts and parts of acts inconsistent herewith are hereby repealed.

The Effect of the War Upon 1917 Road Work—II.

In the issue of last week there were printed reports from highway departments of about one-third of the states on the probable effect of the war upon road work during the present season. In the following paragraphs are additional reports received since last week and others that lack of space made it impossible to present in the former issue.

As noted last week practically all of the reports are from the chief executives of the state highway departments of the states in question. The reports are abridged in some cases on account of the limitations of space.

Kansas

State Highway Engineer W. S. Gearhart of Kansas reports as follows:

"The State of Kansas does not appropriate any money for road work. Our constitution prohibits the state engaging in internal improvements. There will be available from the county and township funds approximately $6,500,000 for highway improvement. A large amount of road work has been planned for this year and everything indicates that the amount of surfaced roads built will be very much greater than at any time heretofore. This is due to the change in public sentiment and the liberal provisions of the new law for financing surfaced roads, and the federal aid that will be available. There is some indication that the people are going to be more conservative on account of the war than they would have been otherwise, but there seems to be no indication at the present time that the war will seriously affect the work planned for this year."

Maryland

Chief Engineer H. G. Shirley of the Maryland State Roads Commission reports on road work in that state in part as follows:

"The effect of war on the road work in Maryland is problematic. At the present time, the greatest effect I see is the shortage of cars and material, and on account of this we are experiencing considerable difficulty in getting the work, now under contract, completed. * * *

"The attitude of the commission is to go ahead with the work they now have under contract and complete it, keeping the maintenance up to the proper standard of efficiency, and to let such other work as we may have funds available to complete."

There is available for 1917 work about $1,200,000 of the remaining portion of the loan for state road work and about $600,000, including the state's and counties' portions, for state aid work, with about $550,000 for maintenance. This will make a total of about $2,350,000 to be expended under the supervision of the State Roads Commission. In addition, Mr. Shirley estimates that about $3,000,000 will be spent by the counties for road work under their own supervision, thus bringing the total expenditure for the year up to about $5,350,000. He states further that he believes that the greater portion of the money has been contracted for and that the full amount will be placed under contract by fall.

Massachusetts

According to a report from Chief Engineer A. W. Dean of the Massachusetts Highway Commission, state funds available for construction and maintenance amount to about $4,000,000 of which about $1,000,000 will be used for maintenance and reconstruction and the balance for new construction. This sum exceeds the amount available in 1916, all of last year's money not having been expended.

In regard to the effect of the war upon road work in the state Mr. Dean reports in part as follows:

"There is no immediate prospect of the entrance of the United States into war having a great effect on the road work in this state. Of course, labor and material are more expensive than in previous years; nevertheless, the high cost of same has not yet caused any cessation in road building activity. Of course, one cannot predict what may happen in the next week, month, or year."

Minnesota

The state road and bridge fund in Minnesota for 1917 amounts to $1,613,500, according to Charles M. Babcock, Commissioner of Highways. About 65% of this will be used for construction, about 25% for maintenance, and the remained for administrative and other expenses. The county road and bridge funds amount to about $3,000,000 and it is expected that the total amount will be expended this year. This is slightly more than was available in 1916, but according to Commissioner Babcock "will probably not allow for any appreciable increase in the amount of work done, on account of the high prices prevailing this year."

In regard to the general situation Commissioner Babcock reports as follows:

"It would be very difficult for me to estimate at this time what effect the war will have on road construction during this coming season. We do know that contractors are very unwilling to take any chance on the labor market and prefer to do the work by force account or to rent their outfits to the counties on a day labor basis. In general though we do not expect that the war will affect the road situation to any great extent and are endeavoring to encourage road work for the reason that this state is an agricultural state and needs the highways to transport produce which is so necessary in order to successfully prosecute the war. We are devoting special attention to the maintenance of the main highways, which we believe is very important at this time."

Mississippi

State Highway Engineer Xavier A. Kramer of Mississippi reports in part as follows:

"So far as I am now able to judge the entrance of the United States into the war will have no material effect on our proposed road work. * * * I estimate that the expenditure for new road work in 1917 will be approximately the same as in 1916. I find a tendency among certain road officials to defer the letting of contracts on account of high prices now prevailing. My judgment, however, is that none of the work will be delayed more than 30 days."

The various counties and districts in the state, according to Mr. Kramer, have available for road and bridge work about $7,500,000, most of which will be used for new work.

New York

The matter of funds available for road work in New York State was covered in some detail in "Good Roads" for May 19. As set forth at that time, there is available about $4,000,000 for the maintenance and repair of state highways and about $2,000,000 for the maintenance and repair of town highways. In addition there is available a considerable sum representing the unexpended balance of the 1916 appropriation for state highway construction. The $2,000,000 available for state aid for town highways is approximately the same as the amount available for the same purpose last year.

A recent report from the Commission of Highways verifies the foregoing data and includes a further statement as to the plans of the department for the present season. The report of Edwin Duffey, State Commissioner of Highways, was reviewed in "Good Roads" for March 24, and attention was called to the situation in the state at the beginning of the current year. The present statement from the department refers to this portion of the report and adds the following:

"As the spring advanced, it became apparent that no improvement could be hoped for, and after the declaration of war by this country and the subsequent discovery of the possible shortage of food and the necessity of utilizing all labor for agricultural purposes, it became apparent that it would be unwise in the extreme for this department to attempt to place any additional work under contract, but that it should bend all its energies toward securing, so far as possible, the completion of work already under contract, aggregating a very large mileage; also, of course, performing the usual maintenance and repair work. The latter is imperatively necessary and must be kept up. The policy of the department at this time, therefore, is to advertise no new work. We have a number of cancelled contracts, and here and there throughout the state there are small pieces of work on which extraordinary conditions prevail, and these we will try to take care of; but aside from that, no new construction will be undertaken and no appropriation was made for that purpose by the legislature. We have some funds available from the 1916 appropriation which will take care of any emergency work required. Present indications are that the construction work this year will not exceed 50% of that performed in 1916, which was really the last year when normal conditions prevailed. This is due entirely to the war, the consequent shortage of labor, and the enormous increase in the cost of materials.

"In regard to the maintenance and repair of state and county highways, would say that the state appropriation this year for that purpose is about the same as that made in 1916, and we hope to be able to have all the work performed. Maintenance work does not require as much labor as construction work."

North Dakota.

According to State Engineer Jay W. Bliss of North Dakota it is expected that about $100,000 of state funds will be available for road work during 1917 and that about $75,000 of this will be used. As this is the first year the state itself has had funds to work with it is not possible to compare this probable expenditure with that of last year.

In addition to the foregoing Mr. Bliss reports as follows:

"There will be spent by the various counties and townships in the state of North Dakota, more money than ever before for improvement of roads. It is not thought that the war will have any material effect on improvements of this nature in this state, inasmuch as the road work in North Dakota will be confined to earth construction largely."

Ohio

State Highway Commissioner Clinton Cowen of Ohio reports as follows:

"I do not believe from present indications that it is going to affect seriously our road program.

"From money derived from the state levy, we will have about $2,200,000 for road work. This money is used in connection or cooperation with the 88 counties. Just what amount the counties may have to cooperate against this money with we do not know exactly but think it conservative to say $6,000,000, or a total of state and county funds of $8,000,000.

"In addition to the above we will have a maintenance fund derived from automobile licenses of approximately $1,500,000, making a grand total of $9,500,000.

"The proposed expenditures are about the same as last year.

"You will note the above does not include the federal aid."

Oklahoma

According to State Engineer Max L. Cunningham the total amount of state funds available for road work during 1917 is $1,500,000. Of this total $500,000 will be used for new construction and $1,000,000 for maintenance. The maintenance fund which is secured from the motor vehicle tax is about 40% greater than in 1916. The construction fund is an entirely new fund as there were no state funds available for this purpose previous to the present year. In addition to these amounts there will be about $350,000 of state funds to equal the federal aid funds for 1916-17 and 1917-18.

Pennsylvania

Chief Engineer W. D. Uhler of the Pennsylvania State Highway Department reports in part as follows:

"It [the war] has acted as an incentive to push our maintenance work this spring, funds for which were made available by an act passed by our present legislature dedicating to this department all moneys derived from the registration of motor vehicles, which, it is estimated, will amount this year to not less than $3,000,000. It is estimated that the amount of money for maintenance will be approximately the same as that expended last year."

At the time Mr. Uhler supplied the above statement the Pennsylvania Legislature had not made appropriations for new work in 1917 and it was, therefore, not possible to give figures on the new construction work for the two years to come.

Rhode Island

Chief Engineer I. W. Patterson of the Rhode Island State Board of Public Roads reports in part as follows:

"The funds available for our work during 1917 are approximately the same as funds available in 1916. All bids received for road reconstruction so far this year have been rejected because of the very high prices prevailing. At present it is the intention of the board to take up no new reconstruction work this year. This will mean a large unexpended balance on hand Jan. 1, 1918."

The available funds for 1917 road work are approximately $500,000 and the funds for 1917 bridge work approximately $175,000. All of the funds for road work must, under the law, be spent for reconstruction and maintenance, reconstruction being defined as the rebuilding of roads that the state has built at some previous time. The funds available for bridge work will be spent for replacing and repairing bridges upon the state highway system. The plans of the board for this year had contemplated the expenditure of about $340,000 for road reconstruction, $160,000 for road maintenance, $150,000 for new bridges and $25,000 for bridge maintenance.

South Carolina

State Highway Engineer J. Roy Pennell of South Carolina reports in part as follows:

"The entrance of the United States into war has, to a limited extent, checked road work in this state for the reason that materials and labor are too high to get a dollar's worth of road for a dollar spent at this time. While I am of the opinion that it is better to put bond issues in bank to draw interest until after the war is over, very little of this is being done. However, several of the counties have been unable to dispose of their bond issues to their satisfaction.

"So far we have bond issues in this state voted since January 1, 1917, of approximately $2,850,000, this as against $600,000 for the year 1916."

Utah.

The tax levy for the counties of Utah has not yet been made up so that it is impossible to state the amount of funds that will be available for road work in Utah during 1917.

State Road Engineer Ira R. Browning reports in part as follows:

"I do not believe the entrance of the United States into war will have any effect upon road work in our state during the coming season."

South Carolina's Highway Department Law

A state highway department was established by the last legislature of South Carolina. Besides the usual provisions relating to the powers and duties of the department and its maintenance, provision is made by the act for the acceptance of federal aid under the terms of the federal aid road act approved July 11, 1916.

The state highway department consists of a state highway commission and a state highway engineer. The commission is composed of two members appointed by the Governor for a term of two years each, and the senior professors of civil engineering of the University of South Carolina, of Clemson Agricultural College, and of the Military College of the State of South Carolina. The office of commissioner is nonsalaried, but an allowance of expenses necessarily incurred in connection with the affairs of the commission is made to members.

The state highway engineer, who is appointed by the commission, and is required to be a competent civil engineer experienced in highway construction and the design and construction of highway bridges, may be selected on the strength of a civil service examination under rules and regulations made by the commission. He receives a salary not exceeding $3,000 a year, and holds office at the pleasure of the state highway commission. Upon the recommendation of the commission the state highway engineer may appoint two assistant engineers at salaries not exceeding $1,800 per year, and may employ other clerical assistants necessary to carry on the work of his office.

The duties of the state highway commission are to advise, assist and cooperate with county road authorities; to ascertain by investigation and experiment the types of roads and road materials best suited to the needs of South Carolina; and to disseminate such information as will aid in the work of constructing and maintaining the roads and bridges of the state. It is required to make an annual report to the general assembly.

Authority for making and promulgating rules and regulations for the registration and licensing of motor vehicles rests with the commission.

The state highway engineer is required to furnish upon the request of county road authorities engineering assistance in the matter of surveys, plans and estimates of costs for constructing and improving roads and bridges, and to either supervise or furnish supervision for the construction and maintenance of roads and bridges. It is his duty to keep records of the work of his office, and to make reports of such work to the commission.

The state highway engineer is also charged with the authority to register and license motor vehicles, and must render a report containing the names of owners and numbers of such vehicles registered from the respective counties to the clerk of the court of each county. "Motor vehicle" is construed to refer to "all automobiles and vehicles, whether propelled by steam, gasoline, electricity or other source of energy other than muscular power, except such vehicles or machines as are used in building of roads, as farming implements, or as are operated only upon rails or tracks."

The annual license fee per vehicle is 25 cts. per hp., A. L. A. M. rating. A dealer's license fee is $15 for each make of motor vehicle sold. Non-residents, duly registered in their own states, are not required to register their cars and pay a license fee in South Carolina unless they remain in the state 30 days or more. On and after July 1, 1917, the penalty for operating an unlicensed vehicle on a public highway or street is a fine of not more than $25, or imprisonment for not more than 15 days.

The funds derived from the registration and licensing of motor vehicles are used for carrying out the provisions of the act. They are deposited by the state highway engineer with the state treasurer, and held by him as a special fund known as the "state highway fund." The law provides as follows:

> The amounts so collected shall be apportioned, one-fifth for the use of the state highway commission, if so much be necessary, and four-fifths to the county from which the registration fees are received; the funds for the use of the state highway commission shall be drawn out on the order of the state highway engineer and the funds for the counties shall be drawn out on the order of the respective county treasurers and placed to the credit of the respective county road funds, or to the sanitary and drainage commission in the counties where such commission is in charge of the constructing of roads and bridges, to be used only for the construction and maintenance of roads and bridges therein.

In assenting to the terms of the federal aid road act the state highway department law of South Carolina directs the state highway department to have prepared all plans and specifications relating to road and bridge projects in the state for submission to the Secretary of Agriculture, to provide sufficient funds to meet its requirements, and in other ways comply with the provisions of the federal law.

Application for federal aid may be made by one county, or by several counties jointly. The priority of such applications received by the state highway commission may be determined, at the discretion of the commission, in accordance with the facts, and are approved "in such order as to make a fair and equitable distribution of the available funds among the several counties, taking into consideration the population, area, mileage of rural delivery routes, and the advantage to be gained for the whole people of the state." The counties are required to give a written guarantee that they will supplement any sum procured from the United States Government for road improvement within the counties, by an equal amount in money, labor or materials. They must also guarantee to procure all necessary rights of way for proposed roads, and to maintain them when completed in accordance with the requirements of the federal law.

It is provided that if no applications for federal aid are received from the counties within the period designated for filing such applications, and in which apportionments of federal funds are available for the State of South Carolina, the state highway commission shall submit to the Secretary of Agriculture a project statement pointing out the roads the construction of which would best serve the interests of the state. To meet the requirements of the act of Congress, the commission is empowered to appropriate all available funds in the state highway fund, outside of the amount required for the maintenance of the state highway department, and, if necessary, further pledge the good faith of the state for the payment of any remaining balance.

Construction Work of the New York State Highway Department in 1916

The activities of the New York State Highway Department during 1916 were reviewed at some length in an article in a previous issue of "Good Roads," which was based upon the annual report of Commissioner of Highways Edwin Duffey. ["Highway Work in New York State in 1916," March 24, 1917, p. 185.] Detailed information on the work of the department of construction is contained in the annual report of First Deputy H. Eltinge Breed which has recently been made public.

During 1916, according to Mr. Breed's report, there were completed and accepted 514.68 mi. of road as against 758.61 mi. in 1915. In addition there was physically completed but not accepted on Dec. 31, 1916, an estimated total of 530 mi., while on Dec. 31, 1915, the estimated mileage completed but not accepted was 532. During 1916 contracts were awarded for 635.87 mi. of roads as against 983.78 mi. in 1915. The mileage under contract on Dec. 31, 1915, was 1,310.98 and on Dec. 31, 1916, this had increased to 1,435.65 mi.

In table I are shown the mileages of different kinds of road placed under contract in 1915 and in 1916.

TABLE 1—MILEAGES OF DIFFERENT TYPES OF ROADS PUT UNDER CONTRACT IN NEW YORK STATE IN 1915 AND 1916.

Kind of Road.	Miles.	
	1915.	1916.
Water bound macadam	352.56	34.83
Water bound mac., surface application	148.28	260.93
Bit. macadam (penetration method)	336.06	200.74
Bituminous concrete (mixing method)	2.20	1.76
Brick block	29.52	12.52
Cement concrete	100.51	123.93
Miscellaneous	14.65	1.16
Total	983.78	635.87

The decrease in the number of miles of road built and the number of miles put under contract in 1916 as compared with 1915 was due, according to the report, to the conditions obtaining during last year, including the scarcity of labor and the inefficiency of that which could be obtained, the lack of supplies and the increase in cost of materials, the reluctance of contractors to undertake work under the conditions obtaining, and the caution of bonding companies in assuring new work. Table II shows the average cost per mile of 16-26-ft. roads of different types, exclusive of engineering and advertising costs, in 1914, 1915 and 1916. This table is made up from the averages of a longer table printed in the report and covers a very large amount of road work in the various counties of the state. The prices, according to the report, are computed using as a basis the prices bid in awarded contracts so that, according to the report, "they exactly represent conditions as viewed by the contractors, many of whom, however, in making these bids, did not allow sufficiently for the rising prices of labor and materials."

TABLE II—AVERAGE COST PER MILE OF 16-26-FT. HIGH WAYS, EXCLUSIVE OF ENGINEERING AND ADVERTISING COSTS, 1914, 1915 AND 1916.

Kind of Road.	Average Cost Per Mile.			Decrease.	Increase.	
	1914.	1915.	1916.	1915-1914.	1916-1915.	1916-1914.
Water bound macadam	$11,049	$10,028	$11,227	9.3%	12.0%	1.6%
Water bound macadam (surface treated)	11,095	9,869	11,826	11.0%	19.8%	6.6%
Bituminous macadam	13,339	11,005	13,725	17.5%	24.7%	2.9%
Concrete	13,518	13.418	14,995	0.7%	11.8%	10.9%
Brick	25,323	24,217	27,739	4.4%	14.5%	9.5%

The work of the department in the preparation of maps has included the making of an engineering review of approximately 1,000 mi. of road plans for the purpose of obtaining thorough information on the possibilities of the roads for military traffic. In addition, surveys, maps and plans have been made in connection with 219 construction contracts and 160 repair contracts, involving a total of 2,666 mi. of work.

Special studies have been made of present and future requirements of traffic and of climatic and soil conditions in their relation to highways. These studies have been supplemented by the analysis of past work and the causes of winter break-ups, a survey of every one of the latter on every state road having been made. The former material surveys made by the department have been amplified and many special examinations have been made. The inspection of materials resulted during the year in the rejection of approximately 3,000 cu. yd. of stone, 1,125 cu. yd. of slag, 125 cu. yd. of gravel, 1,450 cu. yd. of sand and 100 cu. yd. of screenings.

The research work done by the department has included an investigation of the failure of apparently good concrete sands, a study of slag testing methods, work on the development of sand and gravel tests, and a considerable amount of experimental work with bituminous materials.

The work of the Bureau of Tests, including field, experimental and research work and the routine work of checking the amount and quality of materials going into the work, costs about $40,000 a year, or approximately .4 of one per cent. of the total amount of money expended by the department. In 1916 the bureau had 32 employees during the construction season and about 24 between seasons. The work done included the testing of 1,265 samples of bituminous materials, 150 samples of paint materials and 17 samples of miscellaneous materials not bitumens, making a total of 1,432 samples for chemical analysis. In addition to these chemical analyses there were made 71 brick tests, 498 cement tests, 851 tests of concrete cubes, 734 tests of gravel and sand, and 551 stone tests, making a total of 4,137 tests of all kinds. The cement testing of the bureau resulted during the year in the rejection of 1.4% of the amount tested as against 8.63% in 1915 and 11.50% in 1914. It is stated that had the rejected 1.4% been used no serious results would have occurred, as half of it was rejected for failure to meet the 200-mesh sieve requirement and the other half because of flash set. The former, it is stated, would not have injured the cement for the work of the department and the latter half would probably have aged sufficiently to pass the test by the time it reached the job.

During the year 12 grade crossing eliminations were completed, of which 6 were accepted by the Public Service Commission. The others were completed late in the season.

Among the points noted in the report under the head of "New Policies" is the change in the specification for the size of stone for top course and for concrete work from a maximum of 2 in. to stone passing a 2¾ in. ring, which would make the maximum about 2½ in. This change was made, according to the report, because it was the belief of the department that the larger stone would give greater stability both in top course work and in concrete roads, and also because a larger part of the stone crushed locally would be made available by the change, thus decreasing the cost of construction. The results obtained have been favorable and the 2½-in. stone will be continued as the maximum for work of that kind.

Another matter covered under this head is the establishment of a freight bureau by means of which certain reductions in freight rates on sand and stone have been obtained.

Another matter touched upon in this part of the report is the method of surface treating macadam roads. In 1915, it is stated, the department surface treated macadam roads with about ¼ gal. of tar after the road had been under traffic for about three months. On roads that had not had this seasoning a treatment of calcium chloride is applied to carry the road through the winter until a protective coat can be placed upon it by the maintenance department. This method has proved so satisfactory, it is stated, that it will be continued on all construction work.

Ohio Road Work to Be Let

The Ohio State Highway Department has asked for proposals on a large amount of road work, bids to be received at the office of State Highway Commissioner Cowen at Columbus until 2:00 p. m., June 14. The accompanying table shows only work to be done at an estimated cost of $10,000 or more.

LARGE CONTRACTS TO BE AWARDED IN OHIO.

County.	Sec.	Name of Road.	L'gth of Pavt., Ft.	Width of Pavt., Ft.	Kind of Road.	Estimated Cost.
Construction.						
Athens	K-1	Logan-Athens	4,036	16	Brick on stone foundation	$21,818.13
Brown	b	Ripley-Hillsboro	29,008	14	Water bound macadam	28,330.27
Coshocton	D	Newcomerstown-Coshocton	16,310	16	W. b. macadam and monolithic brick	57,625.15
Fulton	L	Toledo-Wauseon	7,090	15	Bituminous macadam	18,384.35
“	L	As above, alternate				17,793.50
Fairfield	M-2	Cincinnati-Zanesville	17,000	16	Water bound macadam	42,158.78
“	M-2	As above			Bituminous (tar) macadam	49,981.92
“	M-2	As above			Bituminous (Asph. A-1c) macadam	54,194.38
“	M-2	As above			Bituminous (Asph. A-1) macadam	52,389.04
Fulton	K-1	Toledo-Angola	6,585	14	Water bound macadam	12,992.03
“	A-1	Liberty-Adrian	5,936	14	Water bound macadam	11,472.03
Gallia	A-1	Ohio River	8,924	14	Water bound macadam	16,801.00
“	F-1	Gallipolis-Jackson	8,700	14	Water bound and bit. macadam	15,633.95
Knox	K	Mt. Vernon-Coshocton	7,812	14	Water bound macadam	23,828.81
Lawrence	K	Ohio River	5,130	16	Concrete	19,256.45
“	K	As above, alternate			Bituminous macadam (Tar T-1)	16,152.47
“	K	As above, alternate			Bituminous macadam (Asphalt A-1)	16,716.83
“	K	As above, alternate			Bituminous macadam (Asphalt A-1-C)	17,093.07
Mahoning	b	Youngstown-Lowellville	7,894	16, 24	Brick	45,530.83
“	Y	Canfield-Poland	9,944	14	Water bound macadam	21,321.10
“	P	Akron-Youngstown	5,893	16	Brick	21,844.05
Medina	L-2	Barberton-Greenwich	6,496	10	Concrete	16,597.21
Morgan	P	McConnelsville-Marietta	10,618	13	Brick	52,133.27
Pickaway	N	Cincinnati-Zanesville	11,793	16	Water bound macadam	19,694.95
Pike	1	Portsmouth-Columbus	5,513	16, 20, 36.5	Brick	30,852.15
Scioto	A-1	Portsmouth-Lucasville	15,892	16	Monolithic brick	73,004.44
					Brick, concrete foundation	74,623.89
					Brick, rolled foundation	80,255.39
					Bituminous macadam (Asph., A-1)	44,755.46
					Bituminous macadam (Tar, T-1)	43,495.91
Stark	B-2	Canton-New Franklin	6,200	16	Brick	38,078.10
Trumbull	H	Niles-Ashtabula	27,150	10	Plain concrete	84,992.88
					Bituminous macadam	76,894.52
Washington	M	Hockingport-Powhatan	5,293	16, 20, 25	Concrete, plain and reinforced	21,782.30
“	O	Marietta-McConnelsville	5,261	16	Concrete	19,767.97
Williams	C	Bryan-Edgerton	19,601	16	Water bound macadam	55,976.86
					Bituminous macadam	67,127.76
					Bituminous macadam	64,688.50
Maintenance and Repair.						
Harrison	j	Bridgeport-Cadi	12,422	12	Water bound macadam resurfacing	15,854.10
Lake	A	Painesville-Warren	8,000	14	Top of asphalt macadam	15,627.35
Lorain	P	Oberlin-Norwalk	7,030	16	Asphalt macadam	15,534.10
					Tar macadam	14,914.45
“	R	Oberlin-Elyria	10,720	16	Bituminous macadam	16,966.12
Medina	N & O	Cleveland-Wooster	17,933	16	Bituminous macadam	28,355.50 26,771.80
Trumbull	C	Warren-Meadville	17,867	14	Bituminous macadam	27,713.70

Military Roads for Panama

Preliminary negotiations for the construction of military highways and a system of railroads for the defense of American territory and the development of the agricultural regions of Panama have been opened between the United States Government and that republic.

The plan contemplates the expenditure of from $40,000,000 to $50,000,000 on the project, the two governments to share equally in the expense of making the improvements. It is reported that Washington will advance $10,000,000 and Panama $5,000,000 to start the work, and that the latter will pledge as security for money advanced to her by the United States the yearly revenue from the canal, $250,000 a year being Panama's guaranteed share, for a period of 40 years. The Congress of Panama recently provided this means of raising the required funds, and for allowing the United States to select the location of fortifications which the military roads will connect. The work of construction is to be done under United States Army engineers.

Recent Road Legislation in Florida

The 1917 Legislature of Florida passed a law amending the act creating the State Road Department which gives the department authority for entering into contracts for the construction of roads, also the laying out of a system of state and state aid roads which are to be improved and maintained under the supervision of the department.

Another law passed by the legislature accepts the provisions of the federal aid law and makes an appropriation to meet it. It is expected that this joint fund will be used for the construction of two main state highways; one running east and west between Pensacola and Jacksonville and the other commencing at the Georgia state line and extending southerly through the center of the state, crossing the east and west road at or near Lake City.

A third act makes provision for the working of 300 state convicts on the roads, the work to be under the supervision of the State Road Department.

A fund for the maintenance of roads and bridges coming under the supervision of the department is provided by another act. This fund is to be apportioned to the various counties in the proportion the assessed valuation of each county bears to the assessed valuation of all the counties. It is provided by the law that in those counties having no improved roads the fund may be used for construction purposes until maintenance charges have been created.

The Contract for Building the Pike Road of Morgan County, Tenn., at an estimated cost of $200,000, has been awarded to the Carr Contracting Co., of Harriman, Tenn.

State Highway Bonds Voted in Oregon

At an election held on Monday of this week the voters of Oregon decided favorably on the $6,000,000 road bond issue. According to a report from the State Highway Department the issue carried by a majority of about 23,000.

Road Projects in Pulaski County, Arkansas

The three highways in Pulaski County, Arkansas, upon which, according to report, it is expected that federal and state aid funds will be chiefly expended, all extend from Little Rock, the capital, to adjoining county lines. The roads are: (1) a portion of the Little Rock-Batesville Road from Little Rock 5 mi. northeast of Jacksonville to the Lonoke County line, a distance of 17 mi.; (2) county section of the Little Rock-Hot Springs Road, from Little Rock southwest to the Saline County line, 19 mi.; and (3) the county's portion of the Little Rock-Pine Bluff Road running south to the Jefferson County line, 27 mi.

Improvement of Proposed Philadelphia-Delaware Water Gap Road

The Easton Motor Association, the Board of Trade and other commercial interests of Easton, Pa., have offered their support to the county commissioners of Northampton County in securing the improvement of the Easton-Doylestown Road as the initial step in the development of a new state highway from Philadelphia to the Delaware Water Gap by way of Willow Grove, Doylestown and Easton.

It is claimed that $150,000 will be available from the state on a 50% basis for road work in the county during the next two years, and it is believed by many that outside of putting the Nazareth-Bethlehem Pike in good condition, money should be devoted to the improvement of the Easton-Doylestown Road.

Military Road Areas

The War Department has designated certain areas in which military operations are most likely to occur and has pointed out that through roads in such areas should take precedence in the matter of improvement by the various state highway commissions. The areas are:

(a) That about Long Island, including most of the states of Rhode Island, Maine, New Hampshire, Vermont, Massachusetts, Connecticut and New York;

(b) That about Chesapeake Bay, including much of the states of New Jersey, Pennsylvania, Maryland, Virginia, North Carolina and Delaware.

(c) The Pacific Coast area, including California, Oregon and Washington;

(d) That near the Mexican Border, including the southern parts of the States of Texas, New Mexico, Arizona and California;

(e) The Great Lakes area, including the states of Ohio, Indiana, Michigan, Illinois and parts of Wisconsin and Minnesota.

The following recommendations as to construction were made:

(1) Roads to have a smooth, hard surface of broken stone or a pavement not less than 20 ft. in width and capable of supporting the loads hereafter specified for bridges; (2) grades not to exceed 5%, except for short distances (less than 50 yd.) where they shall not exceed 10% (3) bridges to be of iron or masonry and of type to support load of a 6-in. howitzer (3,000 lb. on front wheels and 6,500 lb. on rear wheels, distance between axles 12 ft., width of wheel track 5 ft.) or a 3-ton truck loaded (6,000 lb. on front wheels, 8,000 lb. on rear wheels, distance between axles about 10 ft., width between wheels center to center about 5 ft.)

Road Patrol in Iowa

The Foster law providing for a system of road patrol has been passed in the State of Iowa and will become operative July 4. It requires the county board of supervisors to appoint road patrolmen in each county, although an effort was made before the bill was finally passed to make such appointments optional. An important feature of the law is the provision that the roads must be dragged promptly after every rain, all washouts filled up, the roads cleared of impediments, and side ditches opened. An important saving in the expense of repairing roads is expected from the patrol system, and its results will be watched with much interest.

State Highway Improvement in Washington County, Pennsylvania

Good roads enthusiasts of Washington County, Pennsylvania, have taken up with State Highway Commissioner Black the question of improving a portion of State Highway Route 268, from Centreville, on the National Pike, through Fredericktown to Millsboro, a distance of 14,400 ft. A signed and executed agreement whereby the authorities of East Bethlehem Township, through which the proposed improvement passes, contracted to pay three-fourths of the cost of constructing the road, was presented to the commission by the attorney for the township. While offering the fullest cooperation, the department stated that definite arrangements for undertaking the work could not be made until legislative appropriations for road purposes were determined.

New Bridge Over the Pawtuxet River in Rhode Island

A 3-span reinforced concrete arch bridge is to be constructed over the Pawtuxet River, at Norwood, R. I., by the State Board of Public Roads, to replace the present structure which is inadequate to meet the requirements of heavy and increasing traffic.

The plans for the bridge, which were drawn by the bridge engineer of the State Board under the direction of Chief Enginer Patterson, call for a structure 100 ft. in length and 50 ft. in width, with a roadway of 35 ft. width and 7½-ft. sidewalks on either side. The estimated cost of the bridge is $35,000 to $40,000.

It is reported that the work will be started about June 15 and should be completed by the first of November.

NEWS NOTES

Leake County, Mississippi, is planning to build a gravel road from Carthage, the county seat, to the Madison County line, a distance of about 10 mi., where it will intersect highway routes leading to Jackson and to Camden. The county comprises a fertile region but is without railroad facilities.

Improvement of the Lincoln Highway Across Laramie County, Wyoming, has been in progress during the spring. The mileage in Laramie County extending from the Nebraska line to the Albany County line is of earth, and it is said that when completed it will be one of the best roads of the kind in the country. The work in Granite Canyon has been done by convict labor, the road being widened and grades reduced.

California Expended a Grand Total of $33,544,733.52 for highway purposes in 1916, according to the annual report of the state controller. Of the amount, $7,914,270.10 was chargeable to the state, $9,523,993.57 was chargeable to the cities, and $16,106,469.85 to the counties. The sums represent the cost of new construction, improvements, erection of bridges and other structures, new streets, upkeep of streets, curbs and gutters.

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Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

JUNE 9. 1917

WAR TIME ECONOMIES IN ROAD WORK

The maximum road improvement at the minimum cost must more than ever be the policy in road building in this country for the duration of the war.

At no other time in the history of the United States has the need for better roads been greater than it is now. The war has increased the ever present economic need for the best obtainable transportation facilities, and has added a most urgent military need. At the same time road officials are confronted with conditions that make their tasks unusually difficult. Labor is scarce and high priced, materials have advanced in cost, and there are evidences of a tendency in some instances to withhold or tie up necessary appropriations.

The first thing to be done is to convince the taxpayers that road building must not only go on, but must be speeded up to the limit. We believe this is generally recognized by road builders, but it must be brought home to the public. Generous appropriations for road work should be made out of current revenues, for public funds can be spent to better advantage in few ways. Properly safeguarded bond issues should be voted, for it is entirely just to pass on the cost of permanent improvements to the coming generations—for whom as much as for the present generation this war must be won.

Funds once secured must be expended carefully and wisely. There is urgent need for real economy, not for curtailing expenditures, but for making every dollar do the work of two. Extensive and expensive experimenting should be set aside in favor of the judicious use of tried and proved methods and materials. Labor saving machinery should be utilized to the fullest extent. The enormous supplies of local material should be used whenever available. Equipment should be used to the best advantage, kept employed as nearly continuously as possible, and maintained in the best of condition.

The work is one which calls for exceptional efforts on the part of all concerned. The situation involves many problems, and new ones will constantly arise as conditions change. We have entire confidence that the difficulties can be overcome, all the problems solved; but it will necessitate the closest cooperation of all concerned—officials, engineers, contractors, manufacturers, dealers and the public.

THE COMING OF MOTOR TRUCK TRANSPORTATION

Transportation by motor truck over comparatively long distances is becoming more common every day, and there seems to be a strong probability that conditions incidental to America's entry into the world-war will add impetus to the growth of the truck as a factor in long distance hauling. Indeed, it is quite possible that one of the effects of the war will be the establishment of motor truck fleets running on regular schedules as formidable competitors of the railroads.

Within a very few years the motor-driven vehicle has nearly supplanted the team in many lines of urban hauling, and has come to hold an important place in hauling in the country. It has made possible large savings in time and expense in many lines of industrial service, and played a very important part in commercial development.

The conditions that have resulted in the numerous recent instances of long truck hauls—the congestion of the railroads and a serious car shortage—are the ones that seem destined to still further widen the truck's field of usefulness. With greater and greater demands on the railroads for the transportation of military supplies and foodstuffs there will arise a necessity for finding other means of hauling, and the motor truck will undoubtedly demonstrate its usefulness.

Since good roads are essential to the economical and efficient use of the motor truck, engineers will be confronted with the necessity of building roads to carry this heavy traffic, and the public with the problem of providing the funds. The pleasure car has been, and still is, a powerful factor in the creation of a demand for road betterment. The truck may be expected to make the demand even more insistent than it is now.

MAKING THE MOST OF AVAILABLE FUNDS

It is possible for any community to use its available road building funds in either of two ways, economically or extravagantly. For instance, it could concentrate the entire expenditure on a few miles of costly work or it could spread its money over all the principal roads, improving each one in the best way the available funds would permit.

Which plan would the average community elect?

While from a standpoint of economics, or even plain, good business judgment, the latter policy would be the wiser one, there could be no certainty that this course would be pursued. Road funds are not infrequently used for a small amount of excessively costly work when the same total expenditure would bring greater returns if used for more work at a lower unit cost. In other words, funds are not always used for the greatest good to the greatest number and the maximum value received for the sum expended.

Sometimes this is because of politics, sometimes ignorance, sometimes graft. Very often the cause lies in a failure to appreciate the real value of the cheaper methods of road improvement, the economic possibilities in plain macadam, gravel, sand-clay, and ordinary earth roads.

Elsewhere in this issue attention is called to the importance of these types of roads and figures are given showing the extent to which they are built in certain localities. It is only natural that the building of boulevards and the laying of hard, smooth pavements should attract more attention than other road work less spectacular, so to speak, in its nature. At the same time it is a fact that much of the raw material for our industries and the foodstuffs from the farms have to be transported over country roads in localities where funds are not available for building so-called hard surfaced roads. But no community is so lacking in funds that it can not at least put its earth roads into good condition and keep them so.

Efforts to effect the paving of important, heavily traveled roads should not be relaxed; on the contrary they should be redoubled. But neither should the less elaborate kinds of road improvement be overlooked. Every state, county and town must improve its roads—all its roads, if it is to develop its resources to the utmost, spending as much upon each road as the condition of its finances permits and the return to be expected warrants.

Appointment of the West Virginia State Road Commission

In accordance with the new law of West Virginia which was noted in "Good Roads" for March 24, Governor Cornwell has appointed A. Dennis Williams, of Marlinton, W. Va., as engineer member of the commission and T. S. Scanlon of Huntington, W. Va., as the other member. Under the terms of the law Mr. Scanlon becomes secretary-treasurer of the commission.

Mr. Williams has been Chief Road Engineer of West Virginia since 1913, and Mr. Scanlon was formerly Street Commissioner and Treasurer of the City of Huntington, and later its Commissioner of Finance, Taxation and Public Utilities.

Charles G. McCoy of Charleston has been appointed Chief Clerk of the commission. Mr. McCoy is a graduate of West Virginia University.

Lancaster Turnpike Purchased by the State of Pennsylvania

The Lancaster Turnpike, the most important road leading out of Philadelphia, has been sold to the State of Pennsylvania and will be turned over to the State Highway Department and freed of tolls about July 1. It will be repaired immediately after the title has passed to the state.

It is understood that the state will pay $165,000 for the road, which is $200,000 less than the turnpike company asked for it. The sale was made as the result of an agreement between the Lancaster Avenue Improvement Co., owner of the road, and the State Highway Department, whose engineers recently made a thorough survey and inspection of the highway.

The Lancaster Turnpike is a part of the Lincoln Highway and is one of the most traveled suburban roads in southeastern Pennsylvania. The part from which the toll gates will be removed extends from the Philadelphia limits to Paoli, about 15 mi. The freeing of the road will affect many suburbanites adjacent to Philadelphia, and it is believed that a large amount of heavy traffic will be diverted to the turnpike from numerous townships roads, materially lessening the high cost of maintenance of the side roads.

The freeing of the Lancaster Turnpike is the first break in a solid line of toll roads west and south of Philadelphia. It is expected to hasten court proceedings instituted by citizens of Lower Merion to free Montgomery Ave., which practically parallels Lancaster Ave. on the north side of the Pennsylvania Railroad. It is likewise expected to accelerate the movement to free the West Chester Pike, which is extensively used. The Lebanon and Reading Pike is another road which it has been hoped would be taken over by the state. Its condition was recently the subject of an order by the Public Service Commission requiring the turnpike company to undertake proper repair work.

The Lancaster Turnpike is one of the oldest highways leading from Philadelphia toward the western part of the state. Title was passed from the Philadelphia and Lancaster Turnpike Co. to the Lancaster Avenue Improvement Co. in 1888.

Funds for Road Repair and Maintenance in New York State

Of the $6,031,206 apportioned last month by the State Controller of New York for highway repair and maintenance, $4,075,000 was distributed for the maintenance of state and county roads, and $1,956,206 for the repair of town highways. The appropriations by counties are as follows:

County	State and County Roads	Town Roads
Albany	$154,475.00	$25,860.20
Allegany	80,450.00	45,112.80
Broome	102,200.00	29,216.42
Cattaraugus	31,503.00	44,397.50
Cayuga	53,785.00	33,599.72
Chautauqua	23,332.00	43,668.10
Chemung	45,810.00	14,555.00
Chenango	86,240.00	37,056.29
Clinton	46,340.00	26,762.20
Columbia	75,595.00	26,986.78
Cortlandt	65,090.00	18,802.20
Delaware	40,270.00	51,583.40
Dutchess	124,505.00	43,330.93
Erie	204,905.00	57,845.35
Essex	43,000.00	28,310.32
Franklin	39,314.00	29,942.91
Fulton	53,795.00	13,795.00
Genesee	15,152.00	23,576.66
Greene	79,220.00	22,706.79
Hamilton	13,590.00	11,389.42
Herkimer	54,206.00	26,416.35
Jefferson	100,796.00	46,546.53
Lewis	32,956.00	35,541.20
Livingston	81,095.00	30,165.04
Madison	24,595.00	34,321.83
Monroe	158,532.00	53,929.10
Montgomery	92,452.00	17,230.00
Nassau	33,737.00	75,659.00
Niagara	87,960.00	25,552.50
Oneida	158,362.00	53,001.46
Onondaga	159,460.00	39,357.67
Ontario	125,298.00	32,882.50
Orange	135,785.00	39,915.57
Orleans	61,953.00	19,967.43
Oswego	66,665.00	41,004.24
Otsego	86,545.00	38,853.28
Putnam	15,190.00	15,250.00
Rensselaer	191,720.00	25,524.36
Rockland	23,230.00	20,291.43
St. Lawrence	59,434.00	74,329.63
Saratoga	63,625.00	27,686.86
Schenectady	52,265.00	10,048.67
Schoharie	26,925.00	23,217.55
Schuyler	25,300.00	14,000.00
Seneca	24,430.00	15,355.90
Steuben	138,800.00	68,541.32
Suffolk	57,618.00	104,444.54
Sullivan	42,320.00	44,441.20
Tioga	30,800.00	19,776.75
Tompkins	57,700.00	21,724.80
Ulster	144,530.00	40,865.00
Warren	27,175.00	19,159.00
Washington	46,000.00	30,061.06
Wayne	46,370.00	35,347.29
Westchester	168,490.00	65,972.53
Wyoming	10,970.00	25,746.00
Yates	33,140.00	15,580.00

Revenue from Motor Vehicle Licenses in Pennsylvania

The Automobile Division of the State Highway Department of Pennsylvania reports that the money collected from motor vehicle license fees and registrations for the month of May, 1917, amounting to $234,098, shows a decrease of $16,294 in revenue received from this source as compared with the amount taken in during May, 1916—$250,392. No reason is stated for this reduction.

Bitulithic Pavement for Culver Road, Rochester, New York

The legal barrier which for three years interfered with the repaving of Culver Road from East Avenue to Erie Canal Bridge in Rochester, N. Y., was recently removed by the discontinuance of the action brought to enjoin the city from executing a contract for the laying of bitulithic pavement on the ground that the authorities had no power under the charter to lay a patented pavement. The case had progressed to the Court of Appeals when it was dismissed on stipulation of all parties. The bitulithic type had previously been decided upon by a majority of property owners, and the result of the action may be taken as a decided victory for Warren Brothers Co., of Boston, Mass., manufacturers of the pavement.

MEETINGS

Calendar of Coming Meetings

June 12-14.—New York State Conference of Mayors and Other City Officials—Annual Conference, Buffalo, N. Y. Secretary, W. P. Capes, 25 Washington Ave., Albany, N. Y.

June 20-22.—League of Texas Municipalities—Fifth annual convention and joint convention with the Texas Town and City Planning Association, Dallas, Tex.

June 20-22.—Texas Good Roads Association.—Midsummer Convention, Mineral Wells, Texas. Secretary, D. E. Colp, San Antonio, Texas.

June 25-27.—League of Louisiana Municipalities.—Annual convention, New Iberia, La. Secretary, Joseph B. Elam, Mansfield, La.

June 26-30.—American Society for Testing Materials—Annual meeting, Atlantic City, N. J. Secretary, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

June 27-28.—North Carolina Good Roads Association.—Annual meeting, Asheville, N. C. Secretary, Dr. Joseph Hyde Pratt, Chapel Hill, N. C.

American Automobile Association

At the recent annual meeting of the American Automobile Association, held in Washington, D. C., a resolution was passed urging upon Congress the need of legislation to provide for a system of marginal highways paralleling the boundaries of the United States, to be constructed and maintained at the expense of the government, and also to require the improvement of the main radial roads intersecting such marginal highways.

Dr. H. M. Rowe, of Maryland, was reelected President; John N. Brooks, of Connecticut, Secretary, and H. A. Bonnell, of New Jersey, Treasurer. Executive Chairman A. G. Batchelder was also reelected for four years. It was decided to hold the next annual meeting in Washington, D. C.

Illinois Dairymen Favor Road Bond Issue

At the 43d annual convention of the State Dairymen's Association held recently at Danville, Ill., resolutions favoring the $60,000,000 bond issue for roads were adopted. The resolutions follow:

> Whereas, the Dairymen's Association, like all other agricultural organizations, is greatly interested in the movement for better country roads; and
>
> Whereas, the Illinois Highway Improvement Association in session at Danville on December 19, 1916, adopted resolutions calling upon the Fiftieth General Assembly to present to the people at the election to be held November, 1918, the proposition to issue state bonds in the sum of $60,000,000 for the construction of a state-wide system of hard roads; and
>
> Whereas, this method appears the only satisfactory one to construct a reasonably complete system within the space of an ordinary lifetime; and
>
> Whereas, there is no modern movement of such vital interest to all agriculturists and to dairymen in particular as the easy transportation of our products to market; therefore be it
>
> Resolved that this association heartily indorses the proposition to issue state bonds for the purpose of building hard roads; and be it further
>
> Resolved that a copy of these resolutions be forwarded to the Speaker of the House and to the Lieutenant Governor for transmission to the House and Senate.

The Barron County Good Roads Association will hold a good roads meeting on Flag Day, June 12, at Rice Lake, Wis.

At a special meeting on June 1 at Columbus, Ohio, the Ohio Good Roads Federation passed resolutions declaring for a "business as usual" program, and urging increased activity in road building in the state. The Ohio State Grange and the Ohio Automobile Association were represented at the meeting. A commission was appointed to aid in the good roads movement throughout the state.

PERSONAL NOTES

C. E. Johnson has been appointed City Engineer of San Bernardino, Cal.

R. W. Whitaker has been appointed City Engineer of Bakersfield, Cal.

George D. Willets has been appointed City Engineer of Galveston, Texas, succeeding A. T. Dickey.

W. R. Koonce, former Highway Engineer of Houston County, Alabama, has been elected to the same office in Pike County, taking effect June 15.

G. M. Lorraine, formerly City Engineer of Orland, Cal., has been appointed City Engineer of Alhambra, Cal. He takes the place of Charles Hewes, now City Manager.

Arthur H. Blanchard, Professor of Highway Engineering at Columbia Universiay, has been appointed Consulting Highway Engineer to the Board of Water Supply of the City of New York.

Daniel T. Pierce, Executive Assistant, the Barber Asphalt Paving Co., has been appointed by Governor Brumbaugh as Executive Director of the Committee of Public Safety for the Commonwealth of Pennsylvania.

G. E. Land, formerly with the Advertising Department of the National Tube Company, has been appointed advertising manager of the Blaw Steel Construction Co., of Pittsburgh, Pa.

George W. Francis, of Wilmington, Del., has been appointed Secretary to the Delaware State Highway Commission. He is a graduate from the civil engineering department of Delaware College.

Mark M. Trumbull, who was formerly connected with the Illinois State Highway Commission in the design and construction of concrete and steel bridges, is now Assistant City Engineer of Ottawa, Ill., and Superintendent of Highways for La Salle County.

Charles H. Trapp, has been engaged by the Walter A. Zelnicker Supply Co. as Confidential Secretary to the President. Mr. Trapp was formerly associated with James Stewart & Co., of St. Louis, Mo., and lately with Terrell Croft, consulting electrical engineer, of St. Louis.

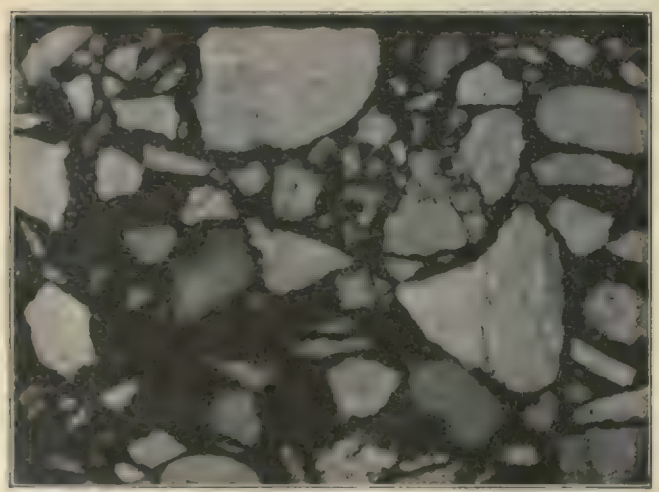
Charles M. Upham, County Engineer of Sussex County, Delaware, has been appointed Chief Engineer of the Delaware State Highway Commission which was created by an act of the last legislature. Prior to his appointement as County Engineer of Sussex County early this year, Mr. Upham was Chief Engineer of the Coleman Du Pont Road, Inc.

EQUIPMENT — TRADE — MATERIALS

Patents Granted on Modifications of "National" Pavement

Patents on modifications of the "National" pavement, which is handled by the Bituminized Road Company of Kansas City, Mo., have recently been granted to the inventor, Michael A. Popkess, assignor to the company.

The "National" pavement as now built consists of an intimate mixture of finely divided earthy material and a bituminous binder. The aggregate, consisting of earthy material, is pulverized, heated, and mixed with the bituminous material in a special patented machine. Complete descriptions of this pavement and of the machine used in its construction have been printed in previous issues of "Good Roads." ["New Methods of Building Bituminized Roads," September 2, 1911, p. 143; "New Bituminized Pavement at Iola, Kansas," April 5, 1913, p. 231, and "An Earth and Asphalt Pavement," March 7, 1914, p. 169.]


CROSS-SECTION OF NEW TYPE OF BITUMINIZED PAVING MIXTURE.

The new patents, which were issued March 27, 1917, are Nos. 1,220,680, 1,220,681, 1,220,682. The first patent describes the construction of the usual type of bituminous pavement with a binder and an aggregate composed of clean, hard, sharp particles of graded sizes and points out that although in most localities there are deposits of "sand, gravel and earthy material, or stone in a more or less decomposed or disintegrated state, sometimes called 'rotten stone' or 'dirty sand and gravel,'" these materials in their natural state cannot be easily combined with a bituminous binder to form a durable product. It is then related that in operating the machine used for the preparation of "National" pavement with materials of this kind the larger particles were not pulverized to dust and did not pass through the screens, but were discharged at the rear. It was discovered that the action of the puverizer, the screens and the heat had thoroughly cleaned these particles and that they "were fractured and polished, and that, in that condition, the mixture of binder and earth would adhere to and coat them, and that the product, consisting of such cleaned stony particles, and of the combined earthy dust and binder, after being compacted, either to form a pavement in situ or into blocks, was practically as coherent and possessed almost as much tensile strength as my previous product made from earth material 'substantially free from sand, gravel and stone.'" It is further explained that in a pavement of this kind the pulverized earthy material mixed with the bitumen fills the voids in the fractured solid particles and acts as a cushion between them, not only binding them together, but actually protecting them from the effects of traffic. Among the advantages claimed for this pavement are that a material which is found almost everywhere and that heretofore "had no commercial value as an ingredient of a paving or the like" can be used, and also that the gravel and stony products act as a filler, so reducing the amount of bituminous binder required and consequently reducing the cost.

Patent No. 1,220,681 covers the construction of a pavement composed of the finely divided earthy material and bitumen used in the construction of the "National" pavement with which has been combined a material like that described in the preceding patent, but which has been subjected to further pulverizing "even to the extent of making dust." The advantages claimed for this type are the same as those claimed for the type of the patent first described.

Patent 1,220,682 is a division of Patent 1,220,681 and covers a pavement consisting of "mechanically pulverized stony material of the nature of silica and silicates such as sand, gravel, pebbles and larger stones, rock, cinders and the like, in the form of impalpable dust, mixed in the proper proportions with a suitable binder, preferably a bituminous binder such as asphalt, and in its preferred embodiment my invention consists in preparing a paving composition from such stony material, in the form of dust, and disintegrated earthy material, such as soil, loam, or clay and the like, in the form of dust, the stony material and the earthy material being mixed in the proper proportions with a suitable binder."

War Committee of the Portland Cement Industry

A committee to represent the Portland cement industry has recently been appointed by B. M. Baruch, Chairman of the Committee of Raw Materials, Minerals and Metals of the Advisory Committee of the Council of National Defense. The personnel of the committee is as follows:

John R. Morron, of the Atlas Portland Cement Co., Chairman; B. F. Affleck, of the Universal Portland Cement Co.; George T. Cameron, of the Santa Cruz and Standard Portland Cement Companies; Richard Hardy, of the Dixie Portland Cement Co., and E. M. Young of the Lehigh Portland Cement Co.

J. P. Beck, General Manager of the Portland Cement Association, will act as secretary of the committee.

The Asbestos Protected Metal Company of Pittsburgh, Pa., has announced the temporary closing of its Atlanta and St. Louis offices. J. R. Nichols, Atlanta Manager, has entered the Officers' Reserve Corps at Fort McPherson, and F. C. Easterby, St. Louis Manager, has entered the Officers' Reserve Corps at Fort Riley, Kans. Communications addressed to the home office of the company in the First National Bank Building, Pittsburgh, Pa., will receive immediate attention, the company announces.

Recent Work of the Forest Products Laboratory of the Forest Service included a trip to 15 Texas cities for the purpose of studying failures and partial failures of wood block pavements. According to a statement by the Forest Service, it was found that failures occurred in those pavements constructed on sand cushions and with sand fillers, while pavements laid on mortar cushions and with bituminous fillers were giving no trouble. Practically all of the failures, it is stated, were due to the development of expansion troubles.

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Work of the Philadelphia Bureau of Highways and Street Cleaning in 1916

The total expenditure for work under the control of the Bureau of Highways and Street Cleaning of Philadelphia during 1916 was $5,482,469.27 according to the report of William H. Connell, Chief of the bureau, whose resignation from that position took effect on May 31 of this year. The principal items of this expenditure were for the construction and maintenance of highways, not including paving, for paving, for the collection and disposal of garbage, for street cleaning and for the collection of ashes and rubbish. The several items included in the total with the cost of each are shown in Table I.

There were in force during the year 632 contracts including those for grading, paving, repaving and resurfacing streets and roads; the construction of parks and boulevards; the collection and disposal of rubbish, ashes and household waste; street cleaning, and bridge and sewer maintenance. These contracts amounted to a total of $6,080,251.37, of which $4,603,914.19, or approximately 76%, was actually expended during the year. Engineering and overhead expenses of the bureau for 1916 amounted to $335,000, equivalent to 6% of the value of the work performed. It is pointed out in the report that this figure is an unusually low one and that while it "in a measure indicates the efficiency of the bureau's operations, it nevertheless shows that the supervising force is insufficient and, as stated in a previous report, should, as soon as possible, be adequately supplemented."

The total mileage of highways constructed and reconstructed during the year is shown in Table II.

The total mileage of streets and roads in the city is 1,703.288, of which 1,164.538 mi. consist of improved pavement, 103.28 mi. of bituminous roads, 250.34 mi. of water bound macadam, 0.35 mi. of granite block pavement on the hills of country roads, 2.56 mi. of concrete road and 182.22 mi. of dirt roads and graded streets.

The street cleaning work of the bureau during 1916 included the cleaning of paved streets having a total area of 18,239,471 sq. yd. Of this total 2,769,800 sq. yd. were cleaned daily, 12,170,000 sq. yd. were cleaned every other day and 3,299,671 sq. yd. were cleaned twice a week. The total number of square yards cleaned during the year is given by the report as 2,687,766,300. The country roads cleaned by the

TYPICAL COUNTRY ROAD IN PHILADELPHIA, PA.—BITUMINOUS CONCRETE WEARING SURFACE ON A PORTLAND CEMENT CONCRETE FOUNDATION.

department had a total length of 356.53 mi. and a total area of 4,068,061 sq. yd. During the year there were removed 471,847 cu. yd. of street dirt and there were collected 1,229,456 cu. yd. of ashes, 680,532 cu. yd. of rubbish and 414,889 cu. yd. of garbage.

In the snow removal work done by the bureau the former equipment of 10 motor truck snow plows was increased by 20, making a total of 30 plows available for the work and resulting in the almost complete elimination of the horse drawn plows. These plows were used on the main thoroughfares as well as in the central business sections and some were also sent into the country to open important roads that had been blocked by drifts. In general the organization for snow removal work was the same in 1916 as in past years.

TABLE I—SUMMARY OF EXPENDITURES OF THE PHILADELPHIA BUREAU OF HIGHWAYS AND STREET CLEANING FOR 1916.

Item.	Amount.
Construction and maintenance of highways (not including paving)	$1,868,968.19
Paving	772,958.00
Northeast Boulevard	67,421.79
South Broad Street Plaza	99,119.83
League Island Park	138,967.78
Parkway	49,106.62
Collection and disposal of garbage	372,397.00
Street cleaning	1,305,015.00
Collection of ashes and rubbish	572,204.50
Removal of snow	41,704.30
Bridge repairs	82,793.16
Sewer repairs	49,544.77
Meadow banks	21,357.25
Mosquito campaign	9,293.43
Clean-up campaign	17,272.38
Miscellaneous	14,345.27
Total	$5,482,469.27

Included in the special work of the bureau touched upon in the report are the improvements on Northeast Boulevard, the Parkway, South Broad Street Boulevard, South Broad Street Plaza and League Island Park. Work on the Northeast Boulevard was commenced in 1903 and was carried on more or less continuously until 1911, when the boulevard was completed and thrown open to traffic between Broad and Second Sts. By that time the grading and preliminary improvements were completed between Second and Rhawn Streets, the total amount expended for it to 1911 having been $1,425,000. In 1913 a contract was executed for the improvement of the boulevard between Second and Rhawn Streets with the exception of side driveways. This was completed in 1915. The original pavement between Broad and Second Streets was water bound macadam and as this was not suitable for the increasingly heavy traffic, a contract was awarded in 1914 for paving portions of the side driveways between Broad and Second Streets, from Tacony Creek Bridge to Rhawn Street, from Tacony Creek Bridge to Alcon Avenue, and from Summerdale Avenue to Rhawn Street, and for resurfacing the central and side drives of the old boulevard between Second and Broad Streets. This contract completed the improvement between Broad and Rhawn Streets a distance of 6.58 mi. The boulevard has a total width of 300 ft. and consists of a central driveway 60 ft. in width, two service driveways each 34 ft. wide, lawn areas 56 ft. in width between the central and side drives, and sidewalks and planting areas at the sides. The work has cost, since the beginning, something over $2,810,000, exclusive of land damages.

TABLE II—MILEAGES OF DIFFERENT KINDS OF HIGHWAYS CONSTRUCTED AND RECONSTRUCTED IN PHILADELPHIA IN 1916.

Kind of Road.	Miles.
Sheet asphalt	22.03
Granite block	15.09
Wood block	1.19
Vitrified block	0.33
Bituminous roads	9.38
Water bound macadam	2.78
Cement concrete roads	0.04
Total	50.84

The boulevard will eventually extend to Pennypack Circle about two blocks north of Rhawn Street, the design being similar to that of the completed section. At Pennypack Circle it will divide into three branches extending on Bensalem Avenue, Poquessing Avenue and Holme Avenue. Each of these will be 150 ft. wide and will include two main driveways each 28 ft. wide on Bensalem Avenue and 26 ft. wide on the other two branches. In June 1915 a contract amounting to $310,000 was executed for the improvement of the boulevard from Rhawn Street to and including Pennypack Circle, Bensalem Avenue from Pennypack Circle to Lexington Avenue, and Holme Avenue from Pennypack Circle to Holme Circle. According to the report this work will probably be completed early this summer. The total cost to the city of the boulevard and its approaches including the amount already spent and that under contract will probably be $5,000,000.

The South Broad Street Boulevard is a continuation of South Broad Street and extends from Oregon Avenue to the entrance of the League Island Navy Yard. From Oregon Avenue to Bigler Street it runs through the Plaza and is 70 ft. wide; from Bigler Street to Pattison Avenue it is 300 ft. wide and from Pattison Avenue to the navy yard through League Island Park it is 143 ft. wide. The portion between Bigler Street and Pattison Avenue contains two service driveways each 26 ft. in width, in addition to the main drive, but in the portion through the park there is only the central driveway which is 50 ft. throughout its entire length.

This improvement was first placed on the city plan in 1905. A contract for its improvement, amounting to $107,602.45, was awarded that year and was completed in 1907. The driveways were originally of water bound macadam, and in order to provide for surface drainage they were built with a series of undulations. In 1912, Olmsted Bros. were employed to study and redesign the entire system of southern developments, and it was decided to redesign the boulevard, paving the side driveways with a pavement adequate for modern traffic, and at the same time eliminating the unsightly undulations in the former pavement. In 1913 a contract was awarded for the reconstruction of the portion between Oregon Avenue and a point 1,650 ft. below Pattison Avenue where it was necessary to discontinue the work owing to plans for the building of a bridge over the Belt Line Railway. The amount of the contract was $199,853.93. The bridge was completed in 1916, but as the fills on the approaches were of considerable depth it was believed inexpedient to continue with the pavement.

The Parkway, which extends from City Hall Square to Fairmount Park, was first projected in 1891. An ordinance authorizing the placing of the Parkway on the city plan was approved in Dec., 1903, and in 1905 $2,000,000 was appropriated for the acquisition of property and the demolition of buildings. Since that time a total of about $3,000,000 has been appropriated for the work. Most of these funds were spent to acquire property but a small amount was used for building a temporary drive from Logan Square to Fairmount Park. The section of the Parkway east of Logan Square, as placed on the city plan, comprises a central driveway 80-ft. wide with a 30-ft. sidewalk space on either side. The section west of Logan Square is to be 300 ft. wide with an 80-ft. central driveway and 26-ft. service drives, with footways and planting areas occupying the remaining space.

The temporary drive between Logan Square and Fairmount Park was opened in 1910 and in 1916 there was completed the improvement of the Parkway between 16th and 17th Streets and between 19th and 22d Streets. In June, 1916, an ordinance was passed authorizing the opening of the entire length of the Parkway and preparations for the improvement during the present year were carried on.

VIEW ON THE PARKWAY, PHILADELPHIA, PA.—LOOKING SOUTHEAST.

TYPICAL VIEW ON NORTHEAST BOULEVARD, PHILADELPHIA, PA.

Considerable space is given in the report to a description of the working of the planning board, which has been described in some detail in a previous article. ["Planning Boards Installed in the Bureau of Highways and Street Cleaning, Philadelphia, Pennsylvania," by Wm. H. Connell, "Good Roads," Sept. 11, 1915, page 168.] Its use, it is stated, "has created a systematic routine of office procedure that has coordinated the multitude of different kinds of work carried on in the district and brought their relation to a central point so that the work of carrying out the procedure is not interfered with by overloading one branch of the work at the expense of another. It simplifies the assigning of the force and the superintendence of the work and it controls within the minimum time allowed all conditions that are created for which outside interests are responsible."

One of the most notable improvements carried out by city labor, according to the report, was that done in the improvement of street and railway intersections paved with granite blocks. The old granite blocks between the rails were taken up, a 6-in. concrete base put down, and the blocks split and redressed and relaid on the concrete with the broken face upward, after which the joints were grouted flush with the top of the pavement. .

The work of surface treating water bound macadam roads with bituminous materials was continued during the year. A total of 185.58 mi. of roads were given such treatment during the year and 116.48 mi. were treated with dust laying oil. The cost of bituminous surface treatment during 1916 amounted to an average of 5.34 ct. per sq. yd. This was a slight increase over the average cost in 1916, and was due, according to the report, to the increased cost of materials and the extraordinary labor conditions which obtained.

The paving work of the bureau during 1916 was done under 209 contracts amounting in the aggregate to $735,697.71, of which $472,836.28 was paid by assessments on property owners and $262,861.43 was paid directly by the city. The contracts covered a total of 30.365 mi. of streets.

Repaving work during the year was carried out under 61 contracts covering 10.144 mi. of streets and amounting to a total of $278,125.23. Most of this work was done on streets of secondary importance on which the existing pavements were unsuited to modern traffic.

Country road work during the year proceeded along the lines followed by the bureau in previous years in its policy of gradually improving all the country roads by laying bituminous surfaces on concrete foundations. A total of $155,420.01 was spent in the improvement of country roads under 21 contracts. In addition there was expended $243,662.12 for work by city forces in construction, maintenance and surface treatment.

A considerable portion of the report is taken up by reports on the Byberry and Bensalem service test road built in 1912 and 1913, and the Oxford Pike concrete service test road built in 1914 and 1915. The construction of these two roads has been covered in previous articles.

Ellicott Driveway, an Important Link in Maryland's Highway System, was opened to the public on June 1. The road furnishes an outlet for the produce of a large section.

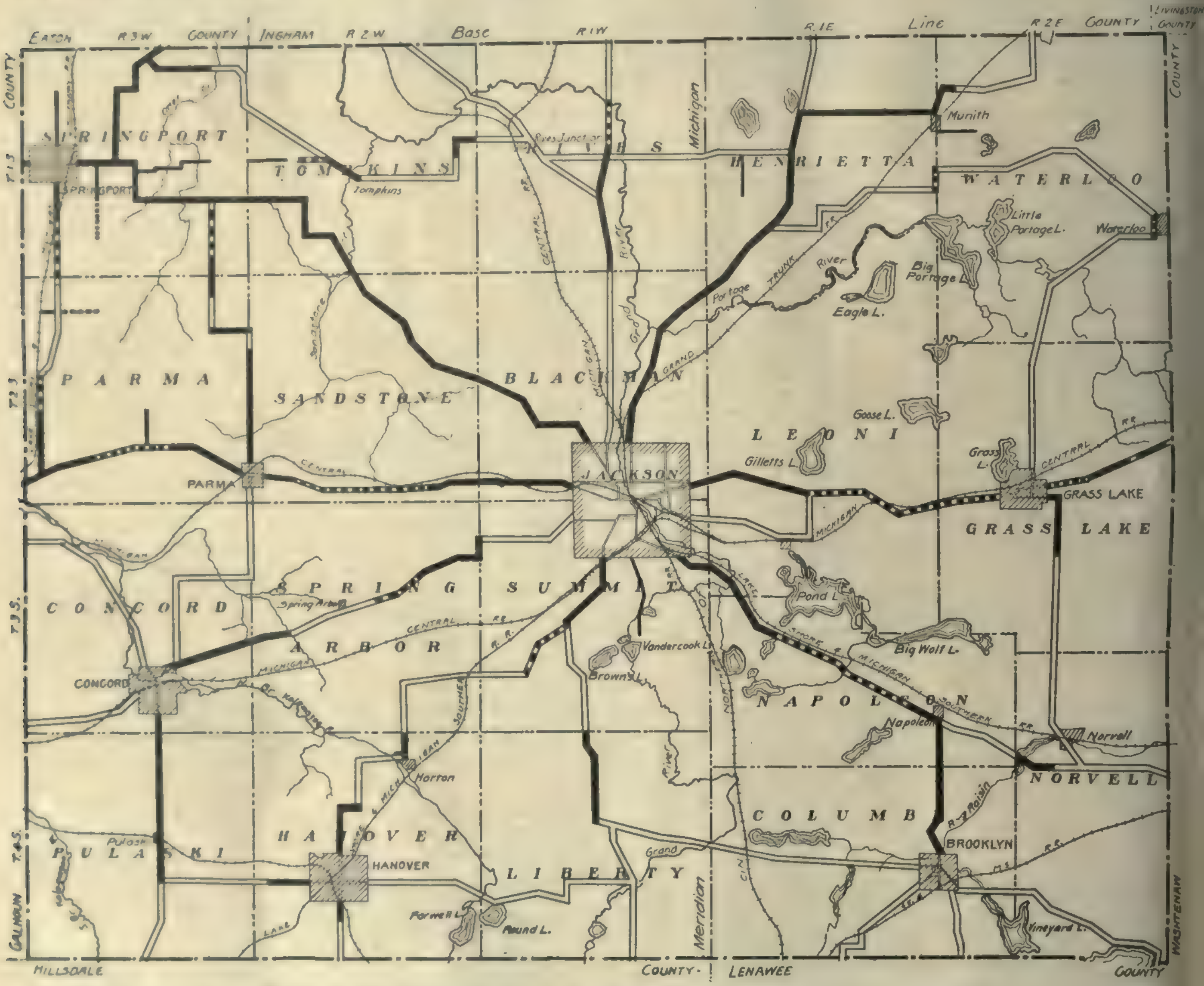
SPLIT GRANITE BLOCK PAVEMENT ON A GRADE ON A PHILADELPHIA COUNTRY ROAD.

NORTHEAST TERMINUS AF THE BYBERRY AND BENSALEM SERVICE TEST ROAD.

Michigan's Trunk Line System

By D. A. THOMAS*

It cannot be said of Michigan's roads that they "start nowhere and go nowhere." But rarely are small isolated pieces of road with no apparent cause for existence to be found on the completed road map of the state. Instead, there are gradually stretching forth from the principal cities and towns along predetermined routes improved roads which, when connected at their ends, will form a network of through highways and serve the state as a whole. These trunk line highways, together with the county road systems correlated with them which serve the individual needs of the counties as units and the centers of population within their borders, form a comprehensive plan designed to bring the greatest possible advantage to the greatest number of people.



MAP SHOWING THE COUNTY ROAD SYSTEM OF JACKSON COUNTY, MICHIGAN.
(Heavy solid lines are county roads built; heavy broken lines, county roads, reward applied for; double lines, county roads, no reward applied for; light solid lines, township roads, reward paid; light broken lines, township roads, reward applied for.)

The establishment of a system of trunk line highways was provided for by an act of the 1913 legislature. The act locates some 3,000 mi. of such roads in a general way by naming the cities and towns along the routes, but, for the most part, the exact lines followed have been determined by the State Highway Commissioner and local authorities after making preliminary examinations and surveys. A restrictive clause limits the number of miles of trunk lines in any county to 3 mi. for each surveyed township, fractional townships pro rata; but upon this basis a maximum of 4,785 mi. is possible in the state. It is probable, however, that the 3,000 mi. determined upon will, when completed, be sufficient to fulfil the larger aims of the system.

During the past four years approximately 1,000 mi. of trunk line road have been built and over 1,000 mi. more are applied for. Thus one-third of the requisite mileage has been completed and another third is in prospect. The larger system, too, comprising trunk lines, county roads, and feeders, is about one-third completed. It has been estimated that with 15,000 mi. of roads built in the state every city, village and hamlet could be reached. Moreover, except in the sparsely settled regions, no farmer would have to drive more than two or three, or possibly four, miles to reach an improved road. On Jan. 1, 1917, a compilation showed approximately 5,000 mi. built according to the specifications of the State Highway Department.

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*Michigan State Highway Department.

Under the highway laws now in force in the state, a reward is paid to all counties or townships on roads constructed according to the state's specifications. There are seven classes of roads eligible to state reward, ranging from sand-clay to concrete and brick. The rewards vary from $250 to $4,200 per mi. for "single reward" roads. The construction of trunk line roads is encouraged by the payment of "double reward"; by the construction, by the state, of all bridges over 30 ft. in span, providing the county builds 3 mi. of road including the bridge; and by providing that the State Highway Department make all surveys for trunk line roads.

A number of "through roads" following trunk line routes have been promoted by various good roads associations in the state. These have been marked and some of them especially mapped for the guidance of tourists, and their construction has been encouraged by these voluntary organizations, in whose make-up the automobile manufacturers, of whom the state has a goodly number, have taken a prominent part. Large sums have been contributed by individuals in some cases. For the most part, however, the burden of actual construction falls on the counties and townships, assisted by the system of state aid.

The West Michigan Pike, for example, following closely the shore of Lake Michigan, stretches from the Indiana line to the Straits of Mackinac at the apex of the lower peninsula and there joins with the East Michigan Pike which follows the trunk line route north and south in eastern Michigan, the two forming the loop of the Dixie Highway in Michigan. The former is, perhaps, the most used through highway in the state and is approximately 75% improved. Offering access, as it does, to the resort region and forming a part of the Dixie Highway, it is each summer traversed by an increasing number of tourists.

Other main highways, some of interstate importance, which are promoted by associations of interested men are the Detroit-Chicago Highway, the Wolverine Pavedway, the Huron Shore Drive, and the Mackinaw Trail in the lower peninsula, and the Cloverland Trail in the upper peninsula. The Cloverland Trail runs through the entire length of the upper peninsula. The western portion of the trail is a long stretch of nearly continuous improved road and the trail is a good road throughout practically its entire length. For many miles the road threads its way through virgin forest; again, much of the land is cut over. Here, however, there has been an interesting development. Teams hauling hay to the lumber camps scattered clover seed along the roads. The seed took root and grew and spread rapidly, until now there are thousands of acres covered with wild clover, from whence the trail derives its name. A branch runs north to the "copper country" while a spur leads south to Menominee on the Wisconsin line.

Mention should be made here also of the use which is to be made of the money available under the federal aid road act. How to do something which could not and would not otherwise be done and how to prevent any counties from holding back in their road work and awaiting federal aid were the problems which confronted State Highway Commissioner Frank F. Rogers when government aid for road construction became a reality. Nearly all the trunk lines have gaps in them where they run through the poorer counties. This is particularly true of the East Michigan Pike and the West Michigan Pike. Under the present state highway laws it would be quite impossible to fill some of these gaps for years to come because the poorer counties and townships could not stand the financial strain. To use the money on trunk line roads in the poorer sections on a schedule whereby the state and the poorest counties each pay 25% of the cost while the Government makes up the remainder was the solution determined upon.

The amount apportioned to Michigan during the 5-year period amounts to $2,186,755.80. Doubling this, it can be seen that approximately $4,250,000 will be spent in the state on federal aided roads. Assuming that such roads as the Government will require will cost on the average $10,000 per mi., over 400 mi. of substantially built road should result which, properly located, will bridge gaps that could not otherwise be filled for years to come. With those roads that will be built under the existing reward system, Michigan's trunk line system should be complete by 1921.

As has already been noted, county road systems are laid out in those several counties acting under the county plan of road building (which includes 61 out of the 83 counties in the state) which tie in, so to speak, to the state trunk line system. The county commissioners are required to designate and map out a system of county roads which will serve the county as a whole—not only those roads which it is proposed to improve during the ensuing year but a comprehensive system comprising the main traveled roads throughout the county. Such mileage of these roads is then improved each year as the funds will permit; until eventually a network of highways covering the entire county is built up. The accompanying map shows the county system of Jackson County, Michigan. The roads running due north and south and east and west through the city of Jackson are trunk lines, the latter being on the route of the Detroit-Chicago Highway.

Motor Vehicle Law of Missouri

A new law governing the operation of automobiles in the State of Missouri will become effective next year. The fees collected thereunder are made payable to the state treasurer and are placed to the credit of the secretary of state for the benefit of the state road fund.

The law provides that the secretary of state may appoint a supervisor of registered vehicles at a salary of $2,000 a year, with necessary traveling expenses, and such other employees as the business of the office demands. He is authorized to establish branch offices in cities having a population of 200,000 or over, and to discontinue such offices during seasons when the volume of registration work is light.

The annual license fees established by the act are shown in the accompanying schedule.

Less than 12 hp	$4.00
12 and less than 24 hp	6.00
24 and less than 36 hp	10.00
36 and less than 48 hp	14.00
48 and less than 60 hp	16.00
60 and less than 72 hp	20.00
72 or more hp	24.00

The horse power of vehicles propelled by gas engines is computed according to the A. L. A. M. formula; that of all vehicles propelled by steam, in accordance with the rating of the manufacturer of such vehicles, and the horse power of all electric vehicles is assumed and recorded as between 12 and 24 hp. The annual registration fee for a dealer in automobiles is $10, and he may obtain as many duplicate sets of plates as he may require upon payment of $5 for each set. A chauffeur's license fee is $1.50. Safety to traffic on the public highways through the use of lights on automobiles is provided by the requirement that each car must carry, from a half hour after sunset to a half hour before sunrise, at least two lighted lamps not exceeding 36 cp. each, "showing white lights, visible, under normal atmospheric conditions, at least 500 ft. in the direction toward which said motor vehicle is facing, which lamp shall produce sufficient light to reveal objects 150 ft. ahead, and shall be adjusted and directed so that, on level ground, the main shaft of clear, condensed light, shall be projected straight forward, and no portion of it shall be above the level of the lamp nor more than 42 in. above the ground. Such adjustment and direction shall be permanently maintained. Electric headlights shall, in addition, have the entire inside surface of their door glasses etched or ground to such a degree or be so formed that the lighted filament shall appear blurred and indistinctly defined, and that the light emitted shall be diffused and free from scintillation and brilliant or metallic luster."

Dirigible searchlights may be used in cities or towns only in cases of emergency when headlights are inadequate, because of rain or fog. The condensed light must then be directed downward below the level of the lamp and not into the eyes of other persons. The searchlights may be used on the highways outside of cities and towns at any time, if the light is adjusted as required.

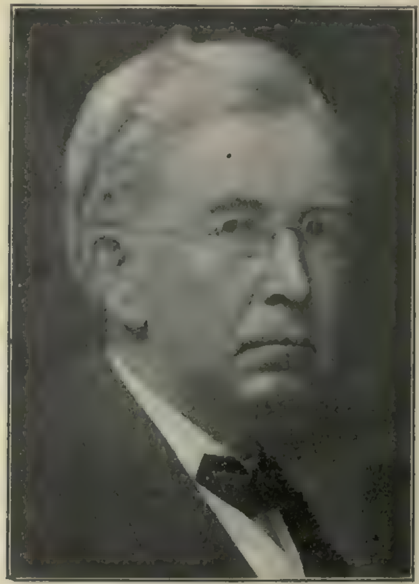
Owners of motor vehicles who have complied with the provisions of the law relating to registration are not required to pay an additional license tax or registration fee to any county or to any city, town or village, except that a city or town may levy and collect license taxes from automobile owners residing therein, which tax may not exceed one-half the state registration fee, but no tax may be levied upon an owner merely passing through such town or city.

A large increase in fees is expected in 1918.

The Newly Appointed State Road Commissioners of West Virginia

As noted briefly in "Good Roads" for June 9, A. D. Williams and T. S. Scanlon have been appointed members of the new State Highway Commission of West Virginia. The appointments were made recently by Governor Cornwell under the new law of the state which was reviewed at some length in a previous issue of "Good Roads."

A. D. WILLIAMS.



T. S. SCANLON.

NEW STATE HIGHWAY COMMISSIONERS OF WEST VIRGINIA.

["West Virginia Embodies Road Laws in Special Act," "Good Roads," March 24, 1917, page 195.]

Mr. Williams, who was appointed as engineer member of the commission, has been Chief Road Engineer of the state since 1913. He was born on a farm in Pocahontas County, West Virginia, May 22, 1878. He received his education in the public schools, and in 1896, 1897 and 1898 taught school, attending college during a part of each year. In 1899 he commenced work in civil engineering as a rodman on the Chesapeake & Ohio Railroad. He worked as rodman, leveler and transitman on the Greenbrier Division of this railroad until December, 1900, when he was made inspector of masonry, continuing that work until September, 1901. During 1902 he served as engineer for the Iron Mountain & Greenbrier Railroad in construction and location work. From September, 1902, until June, 1903, Mr. Williams was engineer for the West Virginia Pulp & Paper Co. in charge of railroad and location work, and during 1904 and 1905 he served as chief engineer of the Iron Mountain & Greenbrier Railroad, and also consulting engineer for the Donaldson Lumber Co., the Marlinton & Camden Railroad Co., and other enterprises. During the following two years he acted as consulting engineer for various land companies.

Mr. Williams was a member of the West Virginia Legislature in 1909, serving as chairman of the committee on roads and, in that capacity, assisting in drafting the revised road laws of the state. He was also the author of the forest, game and fish law and the prohibition amendment to the state constitution which was adopted at the election in 1912. Mr. Williams started in business as a road contractor in 1894 and was also interested in the lumber business. Between 1900 and 1905 he was the owner and editor of the Marlinton "Messenger."

Mr. Williams is a member of many road organizations including the American Road Builders' Association, the American Highway Association, the American Association of State Highway Officials, the Southern Appalachian Good Roads Association, and the West Virginia Good Roads Association. During his term as Chief Road Engineer of West Virginia he was also Professor of Highway and Railway Engineering at the West Virginia University.

Mr. Scanlon, who was appointed as the secretary and business member of the commission, has been connected with construction and contracting work throughout his active business life. He assisted in the making of the first brick used in a pavement in the United States which, it is stated, was laid in Charleston, W. Va., in 1873. He was Street Commissioner and Treasurer of the City of Huntington, W. Va., for five years during the period when most of the pavement of the city was put down. Later, under a new city charter, he served for three years as Commissioner of Finance, Taxation and Public Utilities.

An Inspection Trip Over the Proposed Route of the Fort Worth-El Paso Highway has just been completed by W. B. Starr, Secretary, and J. D. Merriweather, Engineer, of the Fort Worth-El Paso Highway Association. The road is 600 mi. in length and while it is being used, it is said that it will require considerable work to put it in first-class condition, and that steps are to be taken immediately toward improving the entire distance. It is further stated that the eastern end of the highway is in good shape, but that the western division, especially between Sierra Blanca and El Paso is in bad condition.

The Effect of the War Upon 1917 Road Work—III.

In the issues of June 2 and 9 were printed reports from the highway departments of a majority of the several states on the probable effect of the war upon road work during the present year. In the paragraphs following are additional reports received since the printing of those in the issue of June 9 and others which lack of space in the preceding issue made it necessary to present here.

The reports, while abridged in some cases, are authoritative, having been received from the officials in charge of the work.

Arizona.

According to State Engineer Lamar Cobb, state funds available for road work during the fiscal year commencing July 1, 1917, will amount to $1,250,000. Of this over $1,000,000 will be used for new construction. This is about half the expenditure during the fiscal year just ending. Mr. Cobb states further that he does not anticipate that the war situation "will for any great length of time curtail the road expenditures of the various counties, though it may postpone the bond issues for a few months."

Arkansas.

According to H. R. Carter, State Highway Engineer of Arkansas, there will be available for road and bridge work in the state during 1917 $2,250,000 of state funds. Of this amount $750,000 will be expended for new construction, and $1,500,000 will be used for maintenance. In addition, there will be expended about $6,000,000 of funds from road improvement districts.

The proposed expenditures for 1917 will exceed the expenditure in 1916 by about $3,000,000.

Delaware

New Castle County.—Commissioner James Wilson of the New Castle County Highway Department reports that the total of county funds available for road and bridge construction in New Castle County for 1917 is $534,000 and that there is available for maintenance $150,000. This sum, it is stated, is considerably in excess of that available for 1916 because of the voting of a bond issue of $500,000.

Commissioner Wilson's comment on the general situation is as follows:

"As elsewhere, the shortage of labor and lack of transportation facilities are large factors in retarding all our contemplated work. We have partially overcome these by using convict labor on resurfacing work more extensively than before and by hauling stone from local quarries by motor trucks."

Sussex County—County Engineer Charles Upham reports upon the conditions in that county as follows:

"The present high price, which is indirectly due to the war, has held up considerable work in this county. However, I think later on this year a small percentage of the county work will be completed; this a part of the million dollar bond issue.

"The amount of money available, if they decide to do the work, is $1,000,000 to be used in new construction. There is also approximately $100,000 for maintenance of earth roads and maintenance of bridges."

Florida

According to Commissioner William F. Cocke of the Florida State Road Department, the legislature has provided approximately $550,000 to be expended by the department during the next twelve months, inclusive of the federal aid. Of the total, it is stated, approximately $350,000 will be used for construction purposes and the balance for maintenance. Heretofore the functions of the department were only advisory and this year's appropriation is the first it has had for use in road work.

Montana

A report from the Montana Highway Department states that at present it is impossible to furnish estimates as to the work for the coming season.

Nebraska

State Engineer George E. Johnson of Nebraska reports that road work in that state "will proceed this year the same as it has in the past." There is available for state aid bridge work $100,000 and there will be approximately $3,000,000 expended on county road and bridge work.

In addition to the above Mr. Johnson reports as follows:

"We do not expect to start any road work on the state and federal road fund this year, as it will take the greater part of the summer to get our projects surveyed and plans approved. We may be able to award contracts this fall.

"We do not expect war conditions to affect our road work in this state."

South Dakota

It is not expected that the entrance of the United States into the war will have any particular effect upon road work in South Dakota during 1917, according to State Engineer Homer M. Derr. There is available to the highway department the sum of $30,000 for road work up to June 30.

Virginia

The total amount of state funds available for road and bridge work in Virginia, according to State Highway Commissioner G. P. Coleman, is $3,000,000 of which the state has appropriated $235,000 for the convict road force, $195,000 for state money aid and $400,000 for maintenance. The remainder is from general county funds and from county and district bond issues. Of the total amount available $2,200,000 is to be used in new construction and $800,000 for maintenance. These appropriations, it is stated, are about 20% larger than those for 1916.

In addition Commissioner Coleman reports as follows:

"The greatest difficulties which we are experiencing in this state are the lack of labor to properly carry on our construction work, and the lack of cars for delivery of materials for both construction and maintenance work, and it may be necessary, unless these conditions can be relieved, to close down a part of our construction work. This I believe would be a very serious blow to the progress of the state and every effort, I think, should be made to place at the disposal of the highway departments the necessary cars and labor to carry on this important highway work."

Washington

George E. Cotterill, Chief Engineer of the Washington State Highway Department, reports that there will be available for road and bridge work in 1917 about $2,900,000 of state funds and $4,000,000 or $5,000,000 of county funds. Of the state funds about $2,425,000 will be available for construction and about $475,000 for maintenance. These figures are about the same as those for 1916.

Mr. Cotterill reports on general conditions as follows:

"There does not appear to be any likelihood that tax collections will fall short this year by reason of the war or otherwise. More than half of the year's taxes had been paid by March 15, prior to which date a 3% discount is allowed under our laws. There is every indication that the remainder of the taxes will come in at periods ending May 31 and November 30.

"There has been some suggestion of a special legislative session to repeal or reduce some of the appropriations made for the biennium of 1917-18 at the regular session held at the beginning of this year. The Governor, however, has just announced that he believes no sufficient reason exists for any such action.

"If road expenditures are reduced during 1917 it would be by reason of the extremely high prices at which bids are being presented for the season's work. The difficulties and doubts as to being able to secure the necessary labor are compelling contractors to place higher figures than ever before, with the result that road work done this year will cost from 20 to 50% more than in 1916. Bids received during May emphasized this rising tendency to such an extent that the State Highway Board has deemed it advisable to reject more than half the proposals and is now considering the wisdom of proceeding on these projects by direct force account.

"It is certain whatever amount of road work may be in progress at the time of the harvest season will, if emergency demands, be suspended or set aside in order that sufficient labor may be made available for harvesting work.

"Those conditions which relate to our ability to secure labor and materials at anything approaching normal prices will undoubtedly have a considerable effect in reducing the amount of road work during 1917, even though the funds are available."

Wisconsin

State Highway Engineer A. R. Hirst of the Wisconsin State Highway Department, reports that the total amount for road and bridge work during the present year is $3,930,502.83, this being the amount available under the state aid law. There are also expected to be some expenditures under the federal aid law but the amount is not expected to be large this year. The entire amount available under the state aid law will be spent for new construction, the maintenance of roads being the duty of the counties. The funds available for construction this year are approximately the same as in 1916, but it is expected that the actual expenditures will be somewhat less.

In regard to the effect of the war, Mr. Hirst reports as follows:

"This is difficult to answer. We have determined to do all work that can reasonably be done but refrain from forcing the labor market or coming into competition with farmers or other necessary interests for laborers on the road. As a matter of fact, our reports are that, although the wages this year are approximately 10% higher than they were last, the labor supply is, if anything, better. The principal embarrassment we have suffered so far has been the difficulty of obtaining gondola cars for the shipment of sand, gravel and crushed rock, due to the restriction of these cars to coal shipments. We hope that the situation will be improved later in the year."

Program of Road Improvement in Beaver County, Pennsylvania

An agreement has been reached between the Pennsylvania Highway Department and the road authorities of Beaver County under which an extensive program of road improvement will be undertaken in the county without delay. The County Commissioners have agreed that all highway work in the county shall be done on a 50% basis, and are preparing to meet by an equal amount any appropriation made by the legislature for such purposes.

It has been decided that the Monaca-Aliquippa will be the first state aid road to be built, and bids will be asked for its construction before the end of the month. The second state aid project in the county is to commence at New Brighton Borough and extend through Pulaski, Daugherty and New Sewickley Townships, a distance of 20,600 ft. The third state aid road built will be in North Sewickley Township, coupling up two state aid roads already built. This highway is about 4 mi. in length. North Sewickley Township has voted two bond issues for road improvement purposes.

The first state highway to be reconstructed in Beaver County is on Route 77, extending from Beaver Falls to the Lawrence County line, near Koppel. The second state highway for which improvement is contemplated is on Route 204, commencing at Beaver Falls and extending toward the Ohio state line to Darlington.

Under the pending highway appropriation bill, which is likely to become a law, Beaver County will be entitled to $76,599.24 for state highway work; $23,862.34 for state aid roads, and about $6,000 of the federal aid funds.

The Commissioners of Beaver County are E. L. Johnson, J. O. Brown and Fred O. Javens.

New State Road Commission of Utah

Section 1 of Chapter 119 of the laws of Utah, 1909, was amended by the passage of an act March 5, 1917, whereby there was created a State Road Commission consisting of the governor of the state, the state engineer, the attorney general, the secretary of state and the state auditor, all of whom as members of the commission are to serve without compensation. The members of the commission are:

Chairman, Governor Simon Bamberger; Vice Chairman, Harden Bennion, Secretary of State; Dan B. Shields, Attorney General; Joseph Ririe, State Auditor; Geo. F. McGonagle, State Engineer. Ira R. Browning is Secretary and State Road Engineer, and J. O. Borreson is Assistant Highway Engineer.

Road Bond Issue for Greenlee County, Arizona

The taxpayers of Greenlee County, Ariz., have voted in favor of issuing $200,000 bonds for the purpose of constructing the county's portion of the highway between Metcalf and Springerville.

A similar sum has been appropriated by the United States Government on account of national forest roads for constructing 30 mi. of this highway in Apache County, as noted previously. ["Federal Aid Road in Apache National Forest," "Good Roads," Feb. 24, 1917, p. 140.] The road will be 70 mi. long and its construction will be started as soon as the survey is finished and the fund from the sale of the bonds is available.

It is stated that this project when completed will open to the motor tourist one of the most beautiful scenic regions of the West.

A Message of Ex-Governor Johnson of California contained the following references to prison labor on road imprvement in the state: "The camps were built upon specifications of the immigration and housing commission and are as well equipped as any labor camps in the nation. * * * Men have been taken soft from prison and turned into able and efficient units in a real work in which they have come to have a pride. The physical and the mental regeneration of the men in the camps is obvious and apparently with this physical and mental regeneration must come some moral reaction. Aside from the guards, truck drivers and engineers, the entire camp population is convict—convict cooks, waiters, muleteers, blacksmiths, tool men, power men, cobblers and carpenters. There have been during the last year in the Mendocino camps 329 men. Of these, 14 have been returned to prison and their credits forfeited for escaping or attempting to escape. Several attempts at escape were frustrated by the convicts themselves."

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Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

JUNE 16, 1917

THE NEED FOR STRONGER HIGHWAY BRIDGES

If the movement of troops, artillery and supplies over the highways of the country should become necessary, how much time would be lost in strengthening the bridges?

In a paper on reinforced concrete bridges presented at the 1917 meeting of the County Road Engineers' Association of Kentucky, C. D. Snead, Bridge Engineer of the Kentucky Department of Public Roads, quoted statements as to the condition of bridges in New York State. These statements were made by G. A. Ricker, formerly Deputy Commissioner of Highways of New York, during the discussion of a paper presented by Maj. A. A. Fries, of the Corps of Engineers of the U. S. Army, at the Second National Conference on Concrete Road Building held at Chicago in February, 1916. Mr. Ricker stated that there were upwards of 33,000 bridges in the state and that only 10,000 of them were capable of sustaining a rolling load of over five tons. He added that it would be impossible to transport artillery and move troops in any direction over the 6,000 or 7,000 mi. of improved highways in New York State without reinforcing practically all of the bridges of spans greater than 5 ft.

What is true of the highway bridges in the State of New York is undoubtedly true of the highway bridges in a great many other states and at this particular time when the use of the highways for military purposes is demanding increasing attention, it would be well to take into careful consideration this particular phase of the question.

According to a recent report the War Department has recommended that bridges be built to carry a 6-in. howitzer (equivalent to a load of 3,000 lb. on the front wheels and 6,500 lb. on rear wheels, distance between axles 12 ft., width of wheel track 5 ft.) or a 3-ton truck loaded (equivalent to a 6,000-lb. load on front wheels and an 8,000-lb. load on rear wheels, distance between axles about 10 ft. and width between wheels about 5 ft.). In answer to a question put by Mr. Ricker in the discussion previously referred to, Maj. Fries stated that he beileved that if bridges were built to sustain a 15-ton road roller, an army could go over them safely.

These requirements are not excessive and have been met in many instances. While it would be impossible to determine in advance the actual routes over which armies might have to be moved, it would be entirely possible to so direct bridge work as to eventually provide adequate structures on all of the routes of primary importance. The matter should be given most careful attention, for the presence of a weak bridge on a road might cause a delay that would be disastrous in the extreme.

THE EXTENSION OF CONTRACT TIME

One of the principal handicaps, and perhaps the most serious one, under which road building has been carried on during the past year has been that of labor shortage and it is felt certain that this condition will continue during the present season. It has been suggested that the lengthening of the time allowed contractors for the completion of their work would in a large measure remedy this condition and the suggestion seems well worth passing on to the road builders.

Under existing conditions, contractors in some states realize that if, through no fault of their own, work is seriously delayed they will have no difficulty in securing extensions. In other states they know that extensions can be secured only with great difficulty, if at all, and naturally under these conditions they must refuse to take contracts or must put their prices high enough to cover any losses that may be incurred through labor troubles or other causes.

It would be entirely practicable and no more than fair to all parties concerned were public officials to either allow longer time for the completion of work under the conditions that exist at present or announce a definite policy of allowing a reasonable amount of elasticity in the time limit. There is, of course, a small percentage of contractors who will unnecessarily delay a job for various purposes of their own. These contractors, however, are known to the engineers and officials and can, and should, be held strictly to the terms of their contracts. On the other hand there are large numbers who do their best to finish their work on time, but are manifestly unable to do so if they cannot obtain a sufficient labor force. Where the contract time is figured very closely and rigidly adhered to the latter class is at a decided disadvantage and should be given all possible consideration.

In most cases the delay resulting from an extension of time would be no great disadvantage to the party of the first part. Very often it would yield more satisfactory results than insistence upon the letter of the contract.

NEWS NOTES

The City Council of Columbus, Ohio, has authorized a bond issue of $75,000 for widening High St., from Poplar Ave. to Fifth Ave.

The St. Paul Association of St. Paul, Minn., has presented a resolution to the City Council requesting that an improved highway be built from that city to Ft. Snelling.

Fifteen Miles of Streets in Jonesboro, Ark., are to be paved with asphaltic concrete. A contract for the work was recently awarded to the Kaw Paving Co., of Topeka, Kan., on a bid of about $300,000.

A Contribution of $5,000 to the Dixie Highway Association was presented by the president of the association at the recent annual meeting of the Michigan State Good Roads Association. Residents of Detroit contributed one-half of the amount, and the balance came from various cities in the state.

The Legality of a Bond Issue by Clay County, Missouri, has been upheld by the Supreme Court of the state. The issue provides $1,250,000 for highway work, and it is reported that the 202-mi. highway connecting Liberty, Excelsior Springs, Smithville, Holt, Kearney and Missouri City will be built without delay.

Law Providing Road Revenue Enacted by the State of Tennessee

A bill providing revenue for highway purposes was made a public act at the recent session of the legislature of Tennessee. The act provides for the expenditure of such funds by the State Highway Department upon which is imposed the authority to lay out and carry on the work of road improvement in the state. Section 1 of the law explains the method by which the revenue is to be produced, as follows:

> That there is hereby levied upon all taxable property in the state of Tennessee for the year 1917, and annually thereafter, a road tax of one mill on each dollar, said fund to be known as the state aid road fund, and to constitute a separate fund from all other state, county or district road funds in this state. This tax shall be collected, as other taxes are now collected, by the county trustee of the various counties in this state, and reported quarterly to the state highway department, hereinafter called the department, and to the comptroller of Tennessee, and remitted quarterly to the treasurer of the State of Tennessee. These reports and remittances shall be made on or before the first Monday in January, April, July and October of each year.
>
> Said funds shall be kept separate and apart from all other funds, and no part shall be diverted to any other branch of the state government and shall be drawn out of the treasury on the vouchers of the secretary of the department and the state highway engineer. The county trustee shall receive one-half of 1% for collecting said fund, except in counties where trustees are paid salaries, in which counties no charge shall be made for collections.

The fund provided by the foregoing section is distributed in accordance with the provisions of Section 2, as follows:

> That so much of the fund raised under Section 1 of this act, as may be necessary, shall be used in building and maintaining roads and bridges in this state, under the direction of the department and in conformity with the rules and regulations now or hereafter made by the secretary of Agriculture of the United States, hereinafter called Secretary of Agriculture, under the power and authority conferred upon him by the act of Congress of the United States, approved July 11, 1916. * * * * And the remainder of the fund raised under Section 1 of this act shall be used in assisting the various counties of the State of Tennessee in the construction, reconstruction and maintenance of roads and bridges to be known as state aid roads, and for the administration of the fund. Said system of state aid roads shall be composed of the designated system of state highways.

Further relating to state aid to counties, Section 4 provides:

> That it shall be the duty of the department in improving the designated state aid roads or any part thereof in the period provided by the act of Congress * * * * * to apportion the funds, so far as possible, equitably among the various counties, provided, that within the period above mentioned, the department shall aid each of the 96 counties of the state in cooperation either with federal and state funds or with state funds; provided, further that, within the said period, the amount derived from either state, federal, or state and federal funds combined expended in each county by the department shall not be less than $25,000. Provided, that in the event the total assessable valuation of property for the state should be increased in an amount over the assessment for the year 1917, it shall then be the duty of the department to expend the excess so collected under this act so as to give each county 1/96 part of the total increase of the state.

In order to receive the benefits of the act each county is required to give a sufficient guarantee that the requirements of the act will be complied with, and that it will levy an annual tax sufficient to secure the proper manitenance of the roads constructed under its provisions. The roads in the counties must be designated and the contracts let within two years after the passage of the act.

Highway engineers and other experts in road building that it may be necessary for the department to employ in order to make proper use of funds in the development of the system of state aid roads of Tennessee, must first have passed a satisfactory examination before the Dean of Engineering, University of Tennessee, the State Geologist, and the State Highway Engineer. The expenses of assistants and engineers are paid out of the state aid road fund from which there is set aside a sum sufficient to cover the expenses of administration and engineering, which in no event shall exceed 5% of the state fund collected under the act.

The department has full power to act for the state in the acceptance of federal aid, to designate the projects for which federal funds are desired, to make all plans and specifications for building roads and bridges, and when approved by the Secretary of Agriculture to supervise the construction of road work coming within the jurisdiction of the federal law. Road building and the work of the department are carried on in accordance with rules and regulations made by the department, in conformity with the requirements of the Secretary of Agriculture.

A contract for road work under this act is made void if it is shown that a member of the department, or an engineer or any employee thereof, is interested financially, directly or indirectly, in such contract, or is related by blood or marriage within the fourth degree, computing by civil law, with any person, firm or corporation receiving the contract, or any stockholder or other person interested in such firm or corporation. A willful violation of the above provision constitutes a felony.

When a project has been approved and its estimated cost determined, it is incumbent upon the state treasurer and controller to place in a state depository in the county in which the project is located, an amount not less than one-fourth of the total estimated cost of the work, to be subject to the check or order of the secretary for the purposes intended; and it is further provided that after a project has been completed the secretary is required to submit to the state treasurer and county judge or chairman of the county court a statement of the total cost of the work and return to them any balance due the state or county.

Nothing in the act is intended to prevent the various counties or citizens thereof from cooperating with the State Highway Department in the improvement of the system of state aid roads by levying taxes, issuing bonds, or making contributions. The controller and treasurer may anticipate funds collected under the act by issuing short term notes in order that actual work may be started on any project that has been approved.

The public acts of the state governing the operation of motor vehicles therein were amended at the recent session of the legislature in respect to the assessment of fees on the basis of horse power instead of seating capacity. The law makes mandatory on the part of the county court clerk the collection of all licenses, and requires him to see that all motor vehicles owned in the county are registered, and to issue distress warrants after March 1 of each year against all owners who have failed to pay for such registration. The law states that:

> Before the owner of any automobile, motorcycle, auto truck or other vehicle of like character used for the purpose of conveying persons or freight or for any other purposes, whether such vehicle is propelled by steam, gasoline or electricity, or any other mechanical power, shall operate or be permitted to operate upon any street, road, highway or any other public thoroughfare in Tennessee, such owner shall register such vehicle with the state department of highways through the county court clerk in the county in which owner resides, giving the motor number, rated horse power, tonnage capacity of motor trucks and make of same, together with the name and residence of such owner.

For automobiles, motorcycles or other vehicles of this character, the license fee is 30 ct. per rated horse power, according to the formula of the Society of Automobile Engineers.

The fee of 30 ct. per horse power, with an additional $3 per ton, applies to all motor trucks, both freight and passenger. After Sept. 1 in any year, one-half the regular registration fee is charged for all classes of motor vehicles.

Under the new law which took effect April 23, 1917, the transfer fee, in case of a legal sale, is $1 to the state and 25 ct. to the county court clerk. Under the old law the regular registration fee of $5 or $7.50 was charged for transferring a car. Visitors who have complied with the rules and regulations of their own state are permitted to operate their automobiles on the highways of Tennessee for a period of 30 days without being required to go through the formalities of registering their cars and paying the license fees.

The provision relating to demonstration number plates specifies that a manufacturer, dealer or agent may use such plate only while actually demonstrating a car to a prospective purchaser. If the car is used for pleasure or other service it must be provided with the usual registration number plate, for which the charge is $10, with an additional 25 ct. to the county court clerk.

The clerk is required to make a monthly report to the State Highway Department of individual collections, showing in numerical order the name and address of each person to whom a license has been issued.

The law requires that all funds collected for the state by the clerk be deposited in a state bank designated by the state treasurer and placed to his credit as a part of the state and county highway fund. In addition to making a monthly report to the department, of individual collections, the clerk is required to keep an accurate and separate account or such funds and shall on the first day of March, June, September, and December, or as much oftener as may be required by the state department of highways, withdraw from each of such banks 10% of the fund deposited since the last such withdrawal, which fund shall be placed in the state treasury to the credit of the state department of highways for the maintenance of such department and for the payment of all the costs to the department of the collection of such fund, which shall include cost of number plates, printing certificates and other printing pertaining to collection of such fund, postage, clerical help, and such other expense as may be incurred by the department in the collection of this fund, which 10% shall constitute the sole amount that may be withdrawn from this fund. The remainder of the fund shall be expended in the county from which colleced under the direction and supervision of the state highway department in cooperation with the regular legally constituted road authorities of the county in the maintenance of the state highways, and the state highway department and the legally constituted road authorities of all counties shall cooperate with each other in the expenditure of this fund as provided by Chapter 100 of the Public Acts of Tennessee 1915; provided that said fund shall be deposited as the state and county highway fund and shall be drawn out only on vouchers signed by the chairman of the state highway department and the secretary for road work in the county where collected as herein provided; provided further, that the county courts of counties shall direct the expenditure of all of this fund when the state department fails to do so by May 1 of each year, and the state highway commission shall in that case pay to each county its share as said county expends it as directed by the legally constituted road authorities of the county.

First State Highway Commission of Texas

The new State Highway Department of Texas will assume its duties on July 1. Gov. James E. Ferguson recently appointed as members of the commission Curtis Hancock, of Dallas, Chairman; T. R. McLean, of Mount Pleasant, and H. C. Odle, of Meridian. Immediately following their qualification as members of the commission, the commissioners met and considered the applications that had been made for appointment as state highway engineer. George A. Duren, City Engineer of Corsicana, was elected to the office at a salary of $5,000 a year. Mr. Duren is a graduate of the Engineering Department of the University of Texas, and, it is stated, has had much experience in engineering work connected with the construction of roads.

Curtis Hancock, Chairman of the Commission, has taken an active interest in road improvement in Dallas County during the last several years. He says that it will be the purpose of the commission to create as nearly as possible a trunk system of highways in Texas and to bring about uniformity of county road construction so that there may be a general connecting up of all highways.

Under the provisions of the law creating the state Highway Commission, it will begin receiving revenues from the tax upon automobiles on July 1. This tax is based upon the horse power of the motor vehicles, and it is estimated that it will average approximately $10 for each automobile in the state. According to the last census that was taken of automobiles about three months ago, there were at that time about 205,000 of these vehicles in Texas. Based on this number and figuring an average tax of $10 per automobile, the State Highway Commission will receive an annual revenue from this source of more than $2,000,000, all of which is to be expended in road construction. The law provides that there shall be returned to each county one-half of the taxes it has paid to the commission, the remainder being retained by the latter as a fund for state work.

Military Marginal Highway Bill Introduced in Congress

As a result of various conferences of officials of national highway associations a measure providing for a continuous marginal highway around the country to be used for military purposes was prepared and has been introduced in the United States Senate by George E. Chamberlain, Chairman of the Committee on Military Affairs.

The presentation of the bill was the outcome of the work of a committee appointed to consult with Senator Chamberlain concerning the expediency of securing legislation authorizing the establishment of such a highway system. The committee consisted of John A. Wilson, of the American Automobile Association; George P. Coleman, President, American Association of State Highway Officials; Samuel Hill, President, Pacific Highway Association, and former President of the American Road Builders' Association; and John Craft, Chairman, Alabama State Highway Commission.

The preliminary measure was drafted by George C. Diehl, Chairman A. A. A. Good Roads Board; Henry G. Shirley, Executive Chairman, American Association of State Highway Officials; and Osborne I. Yellott, Chairman of the A. A. A. Legislative Board.

While the bill is intended primarily to facilitate the movement of troops and supplies, it is announced that its enactment into law is further expected to aid the postal service, and to assist generally in the distribution of agricultural and manufacturing products. Under its terms the Secretary of War is authorized to have prepared by the Chief of Engineers of the department a comprehensive plan for a continuous highway along the eastern, southern and western boundaries of the United States, and eventually extending along the northern boundary. The cost of constructing and maintaining the highway is to be borne by the Government. The plan also includes as supplementary roads those main intersecting roads already built by the states or that may be built with state or state and federal funds.

The Secretary of War is directed to confer with the highway authorities of the several states and as far as practicable disclose the department's plans in developing the military highway in order that the work may be furthered by cooperation and duplication avoided.

MEETINGS

Calendar of Coming Meetings

June 20-22.—League of Texas Municipalities—Fifth annual convention and joint convention with the Texas Town and City Planning Association, Dallas, Tex. Secretary, Prof. H. G. James, Austin, Tex.

June 20-22.—Texas Good Roads Association.—Midsummer Convention, Mineral Wells, Texas. Secretary, D. E. Colp, San Antonio, Texas.

June 25-27.—League of Louisiana Municipalities.—Annual convention, New Iberia, La. Secretary, Joseph B. Elam, Mansfield, La.

June 26-30.—American Society for Testing Materials—Annual meeting, Atlantic City, N. J. Secretary, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

July 9-11.—North Carolina Good Roads Association.—Annual meeting, Asheville, N. C. Secretary, Dr. Joseph Hyde Pratt, Chapel Hill, N. C.

July 10-11.—Pikes Peak Ocean to Ocean Highway Association.—Midsummer meeting, Colorado Springs, Colo. Secretary, A. W. Henderson, Colorado Springs, Colo.

July 12-13.—League of Michigan Municipalities.—Annual convention, Grand Rapids, Mich. Secretary, Charles A. Sink, Ann Arbor, Mich.

Meeting to Further Road Building

Methods of speeding up road work during the war were discussed at a meeting of men actively engaged in road and street work held at the Automobile Club of America, New York, N. Y., on the afternoon of Friday, June 8. The purpose of the meeting was to devise ways and means of encouraging the increased activity in road work made necessary by war conditions and facilitating the progress of work under the handicaps imposed by those conditions.

Robert A. Meeker, State Highway Engineer of New Jersey, was chosen chairman of the meeting and E. L. Powers, Editor of "Good Roads," secretary. After the Chair had outlined the purposes for which the meeting was called, addresses were made by Governor Carl Milliken of Maine, John F. Richmond, Chairman of the Rhode Island State Board of Public Roads, and others. These addresses were followed by a general discussion during which it was moved that there be transmitted to the various highway departments and governors of the several states a set of resolutions setting forth the conditions that had led to the calling of the meeting and stating the sense of the meeting as to the methods that should be adopted to meet the problem. These resolutions called attention to the increased cost of road construction and the necessity of educating the public to the value of highways for economic and military purposes and placed the meeting on record as advocating: First, that the state highway departments cooperate with the War Department in determining the highways of each state that are important from a military standpoint and the requirements which such highways should meet; second, that each highway department prepare a report on the highways of the state essential for the transportation of agricultural and industrial products; and third, that the governor of each state file with the proper authorities a memorial requesting that railroads be not permitted to place an embargo on the transportation of materials. The resolutions were adopted unanimously. In the discussion which followed various changes in these resolutions were suggested, but were left to the discretion of a committee provided for later.

Much of the discussion dealt with the matter of transporting road building materials, machinery and equipment, and various speakers urged the necessity of putting such freight upon the preferred list, pointing out that road building is vital not only to the ordinary commerce and industry of the nation in time of peace and doubly important for such purposes in time of war, but also to military operations. A motion was made that the Chair appoint a committee to go to Washington and take up with the proper authorities the matter of car service and the placing of road materials on the preferred list. As finally passed this motion called for the appointment of a committee to take up this matter at Washington and also to put into final form the resolutions previously adopted, embodying therein such of the changes suggested at the meeting as it might be deemed advisable to include. It was also moved and voted that the chairman of the meeting act as chairman of the committee and that the number of members be left to his discretion.

In accordance with the action of the meeting the committee has been named as follows:

Robert A. Meeker, State Highway Engineer of New Jersey, Chairman; Carl Milliken, Governor of Maine; Col. William D. Sohier, Chairman of the Massachusetts Highway Commission; Charles W. Gates, ex-Governor of New Hampshire; James H. McDonald, former State Highway Commissioner of Connecticut; John F. Richmond, Chairman of the Rhode Island State Board of Public Roads; George P. Coleman, State Highway Commissioner of Virginia; Arthur H. Blanchard, Professor of Highway Engineering, Columbia University; E. L. Powers, Editor, "Good Roads."

Tri-State Good Roads Association

Officers elected at the annual meeting of the Tri-State Good Roads Association at Medford, Ore., on May 16 and 17, are as follows:

President, J. A. Westerlund, Medford; Vice President, C. C. Chapman, Portland; Secretary, George E. Boos, Medford; Treasurer, J. Edward Allen, San Francisco; Directors: W. C. Leever, of Central Point, and A. Warren Gould, of Seattle.

Pikes Peak Ocean to Ocean Highway Association

The time for holding the midsummer meeting of the Pikes Peak Ocean to Ocean Highway Association has been decided upon as July 10 and 11, and the place, the summit of Pikes Peak. A number of sociability runs are being organized in various sections of the country to attend the meeting in connection with a summer tour for delegates and their families.

One of the important matters to come before the meeting will be the report of the committee on western extension of the highway from Utah through Nevada and California to the Pacific Coast. An investigation is being made of the proposed routes in order that recommendations may be submitted at the July meeting.

An interesting feature of the event will be the automobile trip which it is planned that delegates will take from Colorado Springs to the summit of the mountain over the new Pikes Peak automobile road, a distance of 18 mi. The road is 20 ft. wide and is the highest in the world.

Texas Good Roads Association

As noted in previous issues of "Good Roads," the midsummer meeting of the Texas Good Roads Association will be held at Mineral Wells, Texas, June 20-22. Coincident with this meeting, the Dallas-Texarkana and the Fort Worth-El Paso Highway Associations, the Texas Conservation, Reclamation and Irrigation Congress, and probably the Fort Worth-Roswell Highway Association will meet at Mineral Wells, with at least one joint session. The newly appointed State Highway Commission has accepted the invitation of the Texas Good Roads Association to head the parade from Fort Worth to Mineral Wells, which is to celebrate the formation of the State Highway Department for which the association has been working during its entire existence.

The commission will be in attendance throughout the entire convention, not only to tell its plans and what it desires to accomplish, but to receive suggestions from representatives of the various units of the association in Texas.

Among the speakers who have accepted invitations are A. G. Batchelder, Executive Chairman of the American Automobile Association, whose topic will be "Welding the Nation Together," and Capt. J. D. Fauntleroy, United States District Engineer, who will supervise the distribution of $4,515,750 of federal aid funds in the state. The association has a large membership and it is expected that this will be the largest gathering in its history.

North Carolina Good Roads Association

Announcement is made of the change in the time of holding the annual meeting of the North Carolina Good Roads Association from June 27 and 28 to July 9, 10 and 11. This is due to the fact that a number of the members of the North Carolina Good Roads Association are also members of the Press Association which meets at Wrightsville Beach on June 27 and 28.

Advices received from Dr. Joseph Hyde Pratt, Secretary, are to the effect that the three principal topics for discussion at the Asheville convention will be: 1, Operation of the laws passed by the legislature of 1917 relating to road building; 2, road maintenance, with special reference to the use of the automobile tax in maintenance of the state highways; 3, the building of roads of military value.

The headquarters of the convention will be at the Battery Park Hotel, Asheville, and the program will be announced later.

Conference of Mayors and Other City Officials of the State of New York

The program of the eighth annual conference of mayors and other city officials of the State of New York, a synopsis of which was printed in "Good Roads" for June 2, was carried out at Buffalo on Tuesday, Wednesday and Thursday of this week, practically as planned. Mayor Fuhrmann, of Buffalo, delivered the address of welcome to visiting officials. The entertainment features of the conference included an evening at Shea's Hippodrome, at which the delegates and their families were guests of the management.

Society of Automotive Engineers

The summer meeting of the Society of Automotive Engineers—an organization formed by the union of automobile and tractor engineers with aeronautic and marine engineers—will be held at the Bureau of Standards, Washington, D. C., on Monday and Tuesday, June 25 and 26. Papers and addresses, it is understood, will be confined to practical subjects. Secretary of War Baker has been invited to address the meeting.

PUBLICATIONS

CINCINNATI, OHIO, DEPARTMENT OF STREET, SEWER AND CATCH BASIN CLEANING. Annual report for the year 1916, paper 6x9 in., 31 pp.

This report consists principally of tabular statements following a brief report on the general features of the work. The tables contain not only the usual data on work, but also a large amount of detailed cost data. In many of the tables there are included figures for the previous years as well as those for 1916.

SOMERVILLE, MASS., STREET COMMISSIONER. Annual report for the year 1916, paper 6x9 in., 35 pp.

Included in this report are detailed statements of street construction and repair, sidewalk work, street sprinkling and cleaning and miscellaneous street work performed under the supervision of the street commissioner. A considerable portion of the report is taken up by tabular statements showing the amount and cost of work done. There is also included a table showing the location, length and width of all public and private streets within the city.

AMERICAN HIGHWAY ENGINEERS' POCKETBOOK; Prof. Arthur H. Blanchard, Editor-in-Chief. Flexible leather, 4¼x7 in., about 1,500 pages. John Wiley & Sons, Inc., 432 Fourth Ave., New York, N. Y. $5.00.

Preliminary announcement of the publication of the "American Highway Engineers' Pocketbook" has been made. The book is to be divided into 29 sections, each prepared by a specialist in the particular subject treated. Arthur H. Blanchard, Professor of Highway Engineering at Columbia University, is editor-in-chief and the associate editors are as follows: C. J. Bennett, State Highway Commissioner of Connecticut; H. S. Boardman, Dean, School of Technology, University of Maine; Maj. M. Brooke, C.E., U. S. Army; W. H. Connell, Executive Engineer, Day & Zimmerman, Philadelphia, Pa.; Maj. W. W. Crosby, formerly Chief Engineer of the Maryland State Roads Commission; A. W. Dean, Chief Engineer, Massachusetts Highway Commission; H. B. Drowne, Engineer, Lane Construction Corporation, Meriden, Conn.; Austin B. Fletcher, State Highway Engineer of California; H. A. Gardner, Assistant Director, Institute of Industrial Research, Washington, D. C.; Prevost Hubbard, Chemical Engineer, Office of Public Roads and Rural Engineering, U. S. Department of Agriculture; J. F. Kemp, Professor of Geology, Columbia University; Nelson P. Lewis, Chief Engineer, Board of Estimate and Apportionment, New York City; Dr. J. H. Pratt, Secretary, North Carolina State Highway Commission; J. R. Rablin, Chief Engineer, Metropolitan Park Commission, Boston, Mass.; Francis P. Smith, Dow & Smith, Consulting Engineers, New York, N. Y.; George W. Tillson, Consulting Engineer to the President of the Borough of Brooklyn, New York, N. Y.

NEWS NOTES

The State Highway Board of Washington has asked for bids for the work of clearing, grading and draining 5 mi. of the Olympic Highway in Jefferson County. The portion to be improved extends from the head of Discovery Bay northwesterly to the Clellam County line. The County Commissioners of Chehalis County have let the contract for paving 2½ mi. of the highway between Montesano and Aberdeen, to the Grays Harbor Construction Co., of Hoquiam, for $40,426.40.

A Bridge Over the Susquehanna River at Millersburg, Pa.—one of the historic crossings of this river—is proposed by a bill recently introduced in the state senate by Senator Beidelman. The measure calls for an apropriation of $350,000 for the construction of the bridge which would serve an important purpose as the place of its location is much used as a ferry crossing and at present there is no bridge across the Susquehanna between Harrisburg and Selinsgrove.

EQUIPMENT — TRADE — MATERIALS

Booklets on the Uses of Tarvia

Several illustrated booklets on the general and special uses of Tarvia in road improvement have been issued recently by The Barrett Co., whose main offices are at 17 Battery Place, New York, N. Y.

One of the booklets tells how a Tarvia macadam roadway is constructed. Another gives a full description of the grades of this material and their uses and methods of application, examples of Tarvia roadways being profusely shown in halftones. "Special Uses for Tarvia" and "Tarvia for Country Roads" are self explanatory, while two smaller booklets are devoted to the particular uses and advantages of Tarvia-A and Tarvia-X.

The descriptive matter contained in the booklets is informative in character and the illustrations are ample and excellent.

Use of Cement in Bulk

In view of the high prices of cement containers, the use of cement in bulk is being urged by the Portland Cement Association.

It is stated that the objections that have been made to its use in this manner are not sustained by the experience of those who have used large quantities of bulk cement, for although it is not adapted to every kind of work, where it is used directly from the car at the rate of 50 bbl. a day or more it is more suitable than sack cement. Savings of from 5 to 10 ct. a bbl. are reported on bulk cement, which would mean a saving of $10 per car and up. Freight charges and cost of handling the sacks and often storage facilities are saved. No special equipment or facilities outside of waterproof bins are necessary for handling the bulk cement, and many cement products plants now use the material in this form only.

Data on the Use of Motor Trucks

Pointing out that the horse is a rapidly disappearing factor in the commercial vehicle business, the Garford Motor Truck Co., of Toledo, Ohio, furnishes the following figures from a report on the automobile industry in Los Angeles County, Cal.

In 1900 there were 47,000 horses valued at $5,000,000 in the county, and there were 6 motor cars valued at $8,400. During the next 10 years the number of horses was reduced to 31,000 with a valuation of $3,000,000. The number of automobiles had increased to 11,000, valued at $15,400,000. In the 6 years following the number of horses dropped to 20,000, while the automobiles jumped to the 80,000 mark with a total approximate value of $100,000,000.

Modern Methods of Brick Pavement Construction

The excellent style in which this booklet is presented makes it worthy of notice on account of its general attractiveness as well as the real information which it contains. The booklet refers briefly to the value of brick roads and to the evolution of brick for paving. The advantages of the wire-cut lug brick are pointed out by descriptive matter and half-tone illustrations, and the machinery and methods employed in manufacturing the brick are also shown. The text contains other interesting information for users of this material.

The booklet, which is 8½ x 9¼ in. in size, and is profusely illustrated by halftones of unusual quality, is issued by the Dunn Wire-Cut Lug Brick Co., of Conneaut, Ohio.

"The Galion Way to Better Roads"

The above is the title of a descriptive catalog 9x11½ in. in size and containing 48 pages, published by the Galion Iron Works & Mfg. Co., of Galion, Ohio. While it is stated in the booklet that it is intended to give only the essential features of the line of road machinery manufactured by this company, it contains a large amount of descriptive and explanatory matter accompanied by illustrations consisting of halftones and drawings, some of which are colored, showing Galion cast iron culvert pipe, road graders, screening plants, unloaders, drags, crushers, oilers and other road building equipment.

At the annual meeting of the stockholders of the Cement Products Exhibition Co., in May, B. F. Affleck, was elected President; William Dickinson, Vice President; Blaine S. Smith, Secretary, and E. L. Cox, Treasurer..

The Brick, Terra Cotta & Tile Co., of Corning, N. Y., has become a licensee of the Dunn Wire-Cut Lug Brick Co., of Conneaut, Ohio, and will engage in the manufacture of wire-cut lug paving brick. This company is one of the most important paving brick concerns in its section of the country and is widely known for the quality of its product and the reliability of its business methods. M. E. Gregory is the proprietor of the company.

PERSONAL NOTES

H. B. Grant has been appointed City Engineer of Deer Lodge, Mont.

J. O. Borreson has been appointed Assistant Highway Engineer of Utah.

L. R. Ash, a consulting engineer of Kansas City, Mo., has been made City Manager of Wichita, Kan.

George A. Reed, recently City Engineer of Montpelier, has been appointed Assistant State Engineer of Vermont.

H. M. Sharp, Chief Highway Engineer of the Ohio State Highway Department, in charge of highway construction, has resigned.

C. E. Hickock, who has been connected with the Interstate Commerce Commission, has been made City Engineer of Alameda, Cal.

G. H. Nickell has been promoted from the position of Assistant Engineer of the Wisconsin State Highway Commission to that of Division Engineer.

B. K. West, Principal Assistant Engineer of the California State Highway Commission, has been appointed Chief Highway Engineer of Nevada.

H. D. Bruning, Engineer of the Ohio Paving Brick Manufacturers' Association, Columbus, has been appointed Chief Engineer of the Ohio State Highway Department, succeeding H. M. Sharp, who has resigned. Mr. Bruning was formerly a division engineer of the department and has been connected with the Pennsylvania and other railroads and industries in an engineering capacity.

GOOD ROADS

A Weekly Journal of Road and Street Engineering and Contracting

Old Series, Vol. LI.
New Series, Vol. XIII.

NEW YORK, JUNE 23, 1917

Number 25

Methods and Costs of Street Cleaning and Wastes Disposal in Philadelphia, Pennsylvania

The necessity for "consistent and continuous cooperation between the general public and the municipal government" has been recognized by the Philadelphia Bureau of Highways and Street Cleaning as one of the prime requisites to the successful conduct of street cleaning and wastes disposal operations. Considerable attention is paid to this phase of the work under the head of "Clean Streets Campaign" in the 1916 report of the bureau, a general review of which was printed in "Good Roads" for June 16.

In Philadelphia there are enough laws relating to the matter of clean streets, according to the report, so that, if they were enforced, conditions would be much improved. For a number of years, however, these laws had not been rigidly enforced and it was realized by the city officials that it would be inadvisable as a matter of policy to undertake a very strict enforcement without previous warning. It was therefore decided to conduct a clean streets campaign as a preliminary to the general enforcement of the laws regarding clean streets. This campaign was opened by a mass meeting in June of last year. Addresses were made by the members of the city government and others, and later there was appointed a clean streets committee composed of representatives of the Department of Public Works and of civic organizations. The first step taken by the city officials was the issuance of a general order by William H. Wilson, Director of the Department of Public Safety, and James Robinson, Superintendent of Police, calling attention to the existing laws and ordinances, and indicating that they would thereafter be enforced. This was followed by the printing of 400,000 cards, carrying on one side a brief statement of the objects of the clean streets campaign and a list of "Don'ts" based on the prohibitions in the existing ordinances which it was proposed to enforce. On the reverse side were printed extracts from the laws, together with the penalties for their non-observance. Large placards, printed in red and black, outlining the purposes of the campaign and carrying also the "Don'ts" printed on the notice card were placed in store windows, railroad stations, factory buildings and in various conspicuous places throughout the city. Two of these were also placed in each trolley car operated in the city. A reproduction of this placard is shown in one of the accompanying illustrations.

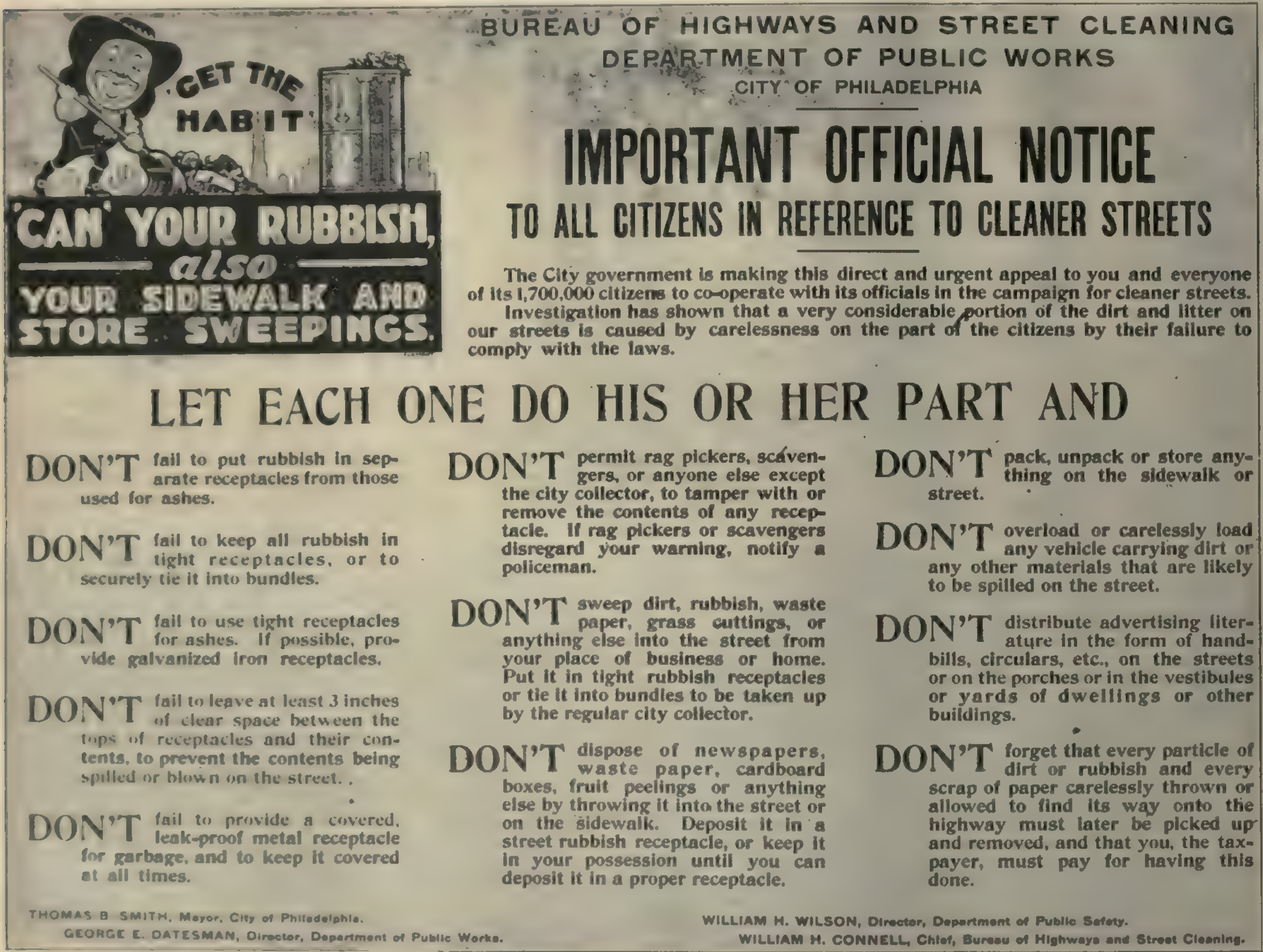
Other measures adopted in the publicity campaign included the sending out of letters and notices, the printing of articles and cartoons in the newspapers of the city, and the issuance of poster stamps.

Hvass Flusher on Saurer Chassis.

Kinney Flusher on Kelly-Springfield Chassis.

MOTOR-DRIVEN STREET FLUSHERS USED IN PHILADELPHIA.

In July, a special force of twelve inspectors was assigned to carry on educational work in sections of the city where it was believed such efforts would bring the best results. This work included a house to house canvass in which the inspectors explained the purposes of the campaign and the requirements of the laws, and urged the cooperation of the householders. Later in the campaign a uniformed policeman was assigned to work with the educational squad for the special purpose of dealing with those cases in which the householders would pay little or no attention to the advice of the inspectors but would immediately obey a uniformed policeman. The campaign also included work in the public and parochial schools. Teachers were furnished with a series of six statements which were read and explained in connection with the classes in civics. An organization known as the Society of Clean-Up Boosters was also formed and the general public invited to become members through series of advertisements appearing in the morning newspapers on six consecutive Mondays. The matter was also taken up in the various churches, and lantern slides were exhibited in the moving picture theaters. Stores were encouraged to hold special sales of approved types of ash, rubbish and garbage receptacles.


GET THE HABIT
CAN YOUR RUBBISH, also YOUR SIDEWALK AND STORE SWEEPINGS.

BUREAU OF HIGHWAYS AND STREET CLEANING
DEPARTMENT OF PUBLIC WORKS
CITY OF PHILADELPHIA

IMPORTANT OFFICIAL NOTICE

TO ALL CITIZENS IN REFERENCE TO CLEANER STREETS

The City government is making this direct and urgent appeal to you and everyone of its 1,700,000 citizens to co-operate with its officials in the campaign for cleaner streets. Investigation has shown that a very considerable portion of the dirt and litter on our streets is caused by carelessness on the part of the citizens by their failure to comply with the laws.

LET EACH ONE DO HIS OR HER PART AND

DON'T fail to put rubbish in separate receptacles from those used for ashes.

DON'T fail to keep all rubbish in tight receptacles, or to securely tie it into bundles.

DON'T fail to use tight receptacles for ashes. If possible, provide galvanized iron receptacles.

DON'T fail to leave at least 3 inches of clear space between the tops of receptacles and their contents, to prevent the contents being spilled or blown on the street.

DON'T fail to provide a covered, leak-proof metal receptacle for garbage, and to keep it covered at all times.

DON'T permit rag pickers, scavengers, or anyone else except the city collector, to tamper with or remove the contents of any receptacle. If rag pickers or scavengers disregard your warning, notify a policeman.

DON'T sweep dirt, rubbish, waste paper, grass cuttings, or anything else into the street from your place of business or home. Put it in tight rubbish receptacles or tie it into bundles to be taken up by the regular city collector.

DON'T dispose of newspapers, waste paper, cardboard boxes, fruit peelings or anything else by throwing it into the street or on the sidewalk. Deposit it in a street rubbish receptacle, or keep it in your possession until you can deposit it in a proper receptacle.

DON'T pack, unpack or store anything on the sidewalk or street.

DON'T overload or carelessly load any vehicle carrying dirt or any other materials that are likely to be spilled on the street.

DON'T distribute advertising literature in the form of handbills, circulars, etc., on the streets or on the porches or in the vestibules or yards of dwellings or other buildings.

DON'T forget that every particle of dirt or rubbish and every scrap of paper carelessly thrown or allowed to find its way onto the highway must later be picked up and removed, and that you, the taxpayer, must pay for having this done.

THOMAS B. SMITH, Mayor, City of Philadelphia.
GEORGE E. DATESMAN, Director, Department of Public Works.
WILLIAM H. WILSON, Director, Department of Public Safety.
WILLIAM H. CONNELL, Chief, Bureau of Highways and Street Cleaning.

POSTER USED IN THE PHILADELPHIA CLEAN STREETS CAMPAIGN.

Another step in the clean-up campaign was the drafting of new rules governing the occupation of highways with building materials. These regulations made it necessary to secure a permit for such use of the highways and to post the permit which was in the form of a placard, in a conspicuous place. The permit was described and illustrated in "Good Roads" for January 13, 1917. ["New Philadelphia Permit Notice for the Occupation of Highways," "Good Roads," January 13, 1917, page 20.]

The prevention of street litter was furthered by the city by placing at prominent locations on the highways and in front of schools about 2,000 rubbish receptacles of the type shown in one of the accompanying illustrations.

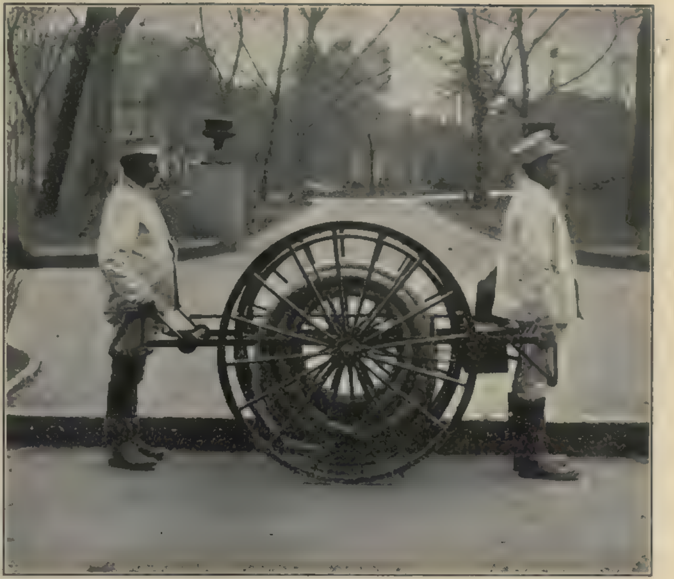
According to the report, the first step in the clean streets campaign, which was educational in its nature, has served its purpose. "It is thought," the report continues, "through the several means of publicity which have been employed during the present year, that the responsibility of the individual in the matter of clean streets has been brought to the attention of each and every citizen." The problem in the future, it is stated, will be simply a matter of enforcing the adequate existing laws.

There are in the city 18,239,471 sq. yd. of paved streets and 4,068,061 sq. yd. of country roads. Of the total yardage of paved streets 2,769,800 sq. yd. were cleaned daily, 12,170,000 sq. yd. were cleaned every other day and 3,299,671 sq. yd. were cleaned twice a week. The average yardage of paved streets cleaned each day amounted to 9,954,690 and the average yardage of country roads cleaned each day to 316,800, making the total yardage of streets and roads cleaned daily 10,271,490. This work entailed the removal of 471,847 cu. yd. of street dirt during the year, which is equivalent to approximately 1 in. of material over the entire 18,239,471 sq. yd. of the city's paved streets.

The work of the bureau also included the collection of 1,229,456 cu. yd. of ashes, 680,532 cu. yd. of rubbish, and 414,889 cu. yd. of garbage, making a total of 2,796,724 cu. yd. of all classes of waste removed during the year. As there are approximately 400,000 householders in the city, this material represents practically 7 cu. yd. for each household, or, based on a total population of 1,700,000, the removal of 1,388 lb. per capita, this total consisting of 796 lb. of ashes, 88 lb. of rubbish, 268 lb. of garbage and 236 lb. of street dirt.

The greatest difference between the street cleaning work in 1916 and that in the previous year was the increased amount of cleaning required, according to the report. The greater portion of the West Philadelphia district, which was

IMPROVED RUBBISH RECEPTACLES USED IN THE PHILADELPHIA CLEAN STREETS CAMPAIGN.



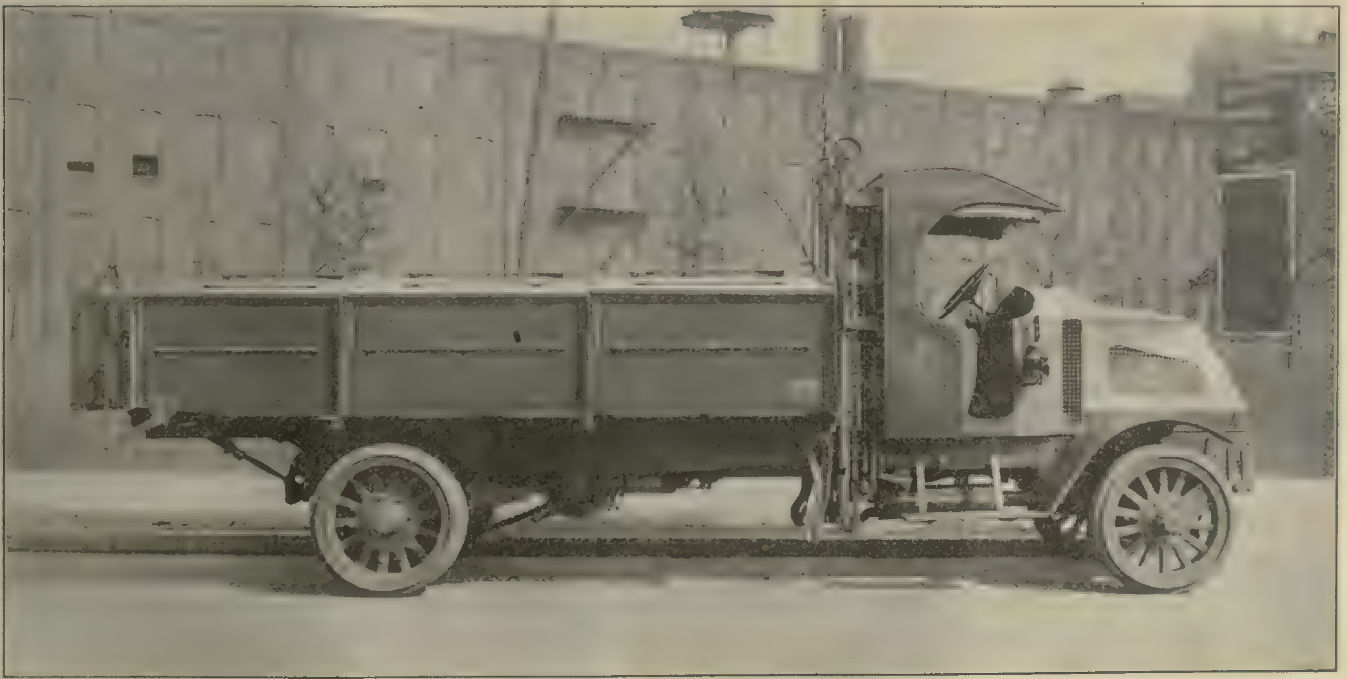
PHILADELPHIA HOSE FLUSHING GANG WITH IMPROVED EQUIPMENT.

cleaned twice a week in 1915, was cleaned three times a week in 1916, and a considerable area in the southern portion of the city, cleaned three times a week in 1915, was cleaned daily in 1916. Similar increases were made elsewhere.

In 1915, automobile flushers were tried out in two districts. Their work was found so satisfactory that in 1916 the number was increased to seven. According to the report these flushers "have proved of inestimable value in dealing with certain unsanitary conditions and were extensively used to great advantage during the epidemic of infantile paralysis which was prevalent in the city throughout the summer, and it is believed that the frequent use of these flushers had a marked influence on the final elimination of this disease." Two of these flushers are shown in operation in the accompanying illustrations. One consists of a Hvass flusher mounted on a Saurer chassis and the other is a Kinney flusher on a Kelly-Springfield chassis.

In 1915 there was also organized a special hose gang for the flushing of streets in the central district. The work done was so satisfactory that two gangs were used in 1916. The equipment used is shown above.

The total cost of street cleaning work during the year, not including the special cost of the clean-up campaign was $1,305,015. The work was done by contract, as in previous years, the specifications and contracts having been improved upon year by year. Up to 1915 the specifications required each contractor to clean the streets at certain intervals and to perform certain other definitely specified work, but did not specify the number of men or the equipment that would be required. In 1915 there was included in the specifications a definite schedule for the minimum labor force and the equipment, and this was found so advantageous to the city that it was continued in 1916. The records of the bureau cover not only the actual work done but also include careful studies and records both of the operation of each unit of equipment and of the entire cleaning per unit area of 1,000 sq. yds. A table showing these costs is reproduced herewith. These cost records, accord-



NEW TYPE OF AUTOMOBILE TRUCK FOR COLLECTING ASHES, PHILADELPHIA, PA.

ing to the report, are of especial value in determining the amount of cleaning to be specified for certain districts.

Up to 1915 the removal of ashes and rubbish was included in the street cleaning contracts, but beginning with that year this work was placed under separate contracts. The separation has proved most desirable from an administrative standpoint, according to the report. The total cost of this work in 1916 was $572,204.50. The use of motor vehicles for the collection of ashes is strongly recommended in the report, which states that in Philadelphia in all cases, except possibly where unusually short hauls prevail, this type of equipment will prove both economical and of advantage to the city, as the horse-drawn equipment is in itself a factor in producing street dirt. A new type of truck for ash collection which, according to the report is expected to finally replace horse-drawn vehicles, is shown in one of the accompanying illustrations.

Garbage collection and disposal during the year cost $372,397. The work was done by contract, as previously.

In 1914 the department inaugurated the custom of holding an annual inspection of the street cleaning force. This inspection which took the form of a parade was held in 1916, immediately preceding "clean-up week." The parade included approximately 229 teams and 236 pieces of equipment in the street cleaning division, 419 teams n the ash and rubbish removal division, and 2,000 men. As in previous years, the parade was reviewed by the city officials and representatives from other cities and local organizations, and prizes were awarded to various participants.

The activties of "clean-up week" in 1916 were conducted entirely by the Bureau of Highways and Street Cleaning. Valuable assistance, however, was rendered by outside organizations. The actual work was preceded by a publicity campaign. The results are discussed in the report in part as follows:

"Everywhere the educational advantages of previous campaigns were apparent, not only being shown in the character of the rubbish put out, but in the way that it was bundled together and piled on the sidewalks for collection. The accumulations were most noticeable for the absence of heavy and cumbersome articles, such as furniture, whole or in part, bed springs, mattresses, etc., which characterized the 'clean-up weeks' of 1913 and 1914; instead there appeared minor household waste and refuse—discarded tin and iron ware, kitchen utensils, rags and carpets, broken chinaware, glass and bottles. Receptacles holding great quantities of very small trash and dirt were proof enough of the care and attention with which householders had gone into the cleaning-up process. Many neighborhood societies and juvenile organizations contributed largely to the outpouring of waste and dirt through their efforts in inducing the housewives and children of their community to 'clean up.' More stress was laid on the elimination of filth and standing water than ever before, since it had been demonstrated that the house fly, or 'typhoid fly,' as it is generally known, is the connecting link between filth and the home. Similarly there was no lack of evidence to show that any puddle of water, no matter how small or filthy, was an acceptable breeding place for mosquitoes, which are generally proficient with flies as disease carriers."

During the week 90,000 cu. yds. of excess rubbish were collected and carried to the city dumps. The additional cost for labor and teams amounted to $17,272.38 and the cost for printing and advertising was $1,150.65, according to the report, making a total of $18,423.03, representing a unit cost of 20.4 ct. per cu. yd. for the waste handled.

DISTRICT NUMBER	MACHINE BROOM						SQUEEGEE		FLUSHER	HOSE FLUS'G	BLOCKMEN	DISTRICT NUMBER
	SPECIAL BLOCK TESTS					AVERAGE FROM DISTRICT REPORTS	AVERAGE FROM BLOCK TESTS	AVERAGE FROM DISTRICT REPORTS	AVERAGE FROM DISTRICT REPORTS	AVERAGE FROM DISTRICT REPORTS	AVERAGE FROM DISTRICT REPORTS	
	GRANITE BLOCK	BRICK	WOOD BLOCK	SHEET ASPHALT	AVERAGE ALL CLASSES							
1-A	.183			.134	.179	.196	.131	.223			..083	1-A
1-B	.220	.193	.177	.128	.212	.202	.174	.204			.081	1-B
2	.290	.211		.160	.280	.323	.130	.196	.156		.179	2
3	.266	.171	.135	.145	.252	.330	.118	.094	.157	.474	.282	3
4-A	.243		.203	.188	.241	.320	.176	.126	.174		.216	4-A
4-B	.242	.218	.205	.168	.216	.252	.115	.115	.		.140	4-B
5	.271	.218	.157	.182	.232	.462	.218	.192	.148		.111	5
6	.234	.178		.163	.205	.256	.137	.182	.150		.174	6
AVERAGE	.246	.193	.166	.159	.226	.282	.148	.156	.157	.474	.152	AVERAGE
Gallons of water used per 1000 Sq. Yds. cleaned						98		240	522			
Cubic yards of dirt removed per 1000 Sq. Yds.						.158		.031	See Note		.051	

Note:—Squeegees used on sheet asphalt and wood block streets only.
Flusher dirt removed by blockmen.
Cost of labor and equipment per day assumed as follows:

Superintendent	$4.00	Machine Broom	$5.50
Foreman	2.50	Squeegee	6.00
Gangmen	1.75	Auto Flusher	15.00
Blockmen	1.50	Dirt { Wagon Cart	5.00 3.50
Dumpmen	1.50	Sprinkler	5.00

TABLE SHOWING COSTS OF STREET CLEANING DURING 1916—PHILADELPHIA BUREAU OF HIGHWAYS AND STREET CLEANING.

Bond Issue Proposal to Be Submitted to Illinois Voters

The bill proposing a $60,000,000 bond issue for road improvement in Illinois, which has been before the legislature of the state for some time, has been finally passed by that body. It provides for the submission of the issue to a state referendum at the November election in 1918. It is proposed to construct 4,400 mi. of roads with the proceeds from the sale of the 20-year bonds.

Paving Contracts*

By W. EARL WELLER†

It is to be regretted that the title of this paper is misleading. There is no intention to lead a weary chase over the rough field of paving contracts and specifications. Rather the paper aims to be a protest against red tape in city affairs—not the red tape that protects but the red tape that binds and costs. Paving contracts are merely selected as a shining example of the costliness and annoyance of such useless procedure. For years city officials—especially those employed in connection with public works—have occupied a position midway between the realm of his Satanic majesty and the blue, briny deep. On the one side they have been compelled to face the law as it is with its innumerable and costly little exactions and kinks—all devised by hard working, well meaning theorists with the purpose of protecting defenceless municipalities from the depredations of piratical officials. On the other side they have been contronted with the criticism of the taxpayer over increased taxes and tardy service. It has been impossible to reconcile the exactions of the law and the requirements of the people, and the net result has been disgust and discouragement for the official and discontent and suspicion for the citizen.

Back in the old days when cities were small, their needs few, their management an avocation, it was well enough to devise checks on the power of officials to do wrong or to make mistakes. Cities have now outgrown their swaddling clothes. Their needs are many and their management has become a vocation—a profession. It is time to change the antiquated machinery of municipal government. Not a radical change, if you please, that will leave us gasping in the midst of chaos but rather a gradual conforming to the common principles of business—an abandonment of the useless red tape that compels us to traverse two sides of the triangle instead of one in arriving at a goal.

It is not the purpose of this paper to search a brother's eye for the biblical mote. Instead it aims to find its horrible example right at home. Hence to point a general protest against a useless waste, let us consider a specific case—"Paving Contracts in Cities of the Second Class." Let us consider the wonderful maze we must tread, the time we must waste and the money we must spend before we may turn a spadeful of dirt in actual work. Let us see if this one example will not aid in the discovery of dozens of others so that the work of correction may be considered worthy the attention of this powerful organization.

Section 124 of the Second Class Cities Law, with the omission of words not necessary for our purpose, reads as follows:

> The Common Council shall prescribe the materials to be used in paving streets of the city and fix the standard of excellence and test required for each such material. The city engineer shall prepare standard specifications in accordance with such ordinance for the performance of the work involved in such improvements with each kind of material so prescribed. Whenever the Common Council shall determine to make any such improvement and the proceedings provided by law as preliminary thereto shall have been taken, the Board of Contract and Supply shall advertise for proposals for the furnishing of the materials and the performance of the work involved in such improvements, and specifications shall be prepared and proposals shall be invited for the construction of such improvement with each kind of paving material so prescribed by the Common Council. In case the expense of any such improvement is to be assessed upon the property abutting upon the street to be improved and more than one kind of material is prescribed, the secretary of the board shall, within one week after proposals have been received, cause to be published in a daily official newspaper for four successive days a notice containing a summary statement of all such proposals. A majority of the property owners, owning not less than one-third of the feet front of property abutting on such street may present to the Board of Contract and Supply a petition designating the general kind of material to be used in making said improvement. If no part of the expense is to be assessed upon the property, or if such expense is to be so assessed, but the property owners shall not have made a designation, the Common Council shall designate the kind of material to be used in making such improvement, and the contract for such improvement shall be awarded for the kind of material so designated by the property owners or Common Council.

What a wonderful creation, with its delays and its absolute separation of responsibility and power!

Let us consider first the time element entering into the case. Property owners are not inclined to think very strongly on the subject of pavements during the coal-shoveling period, but with the advent of spring they dust off the automobile and begin to realize that the muds of spring and the dust clouds of summer are again knocking at the door. Then ensues a hurry up call for Alderman Jones, a mad rush to the city engineer's office and a petition for a pavement "duly presented at the next regular meeting of the Common Council." Said petition is—also "duly"—referred for an interval of two weeks to a committee of the council. The committee then reports and, if the report is favorable, an ordinance is introduced at the same meeting. A hearing is advertised on this ordinance and two more valuable weeks slip into history. After the hearing, the ordinance may be passed and the pavement is temporarily before the Board of Contract and Supply. This board adopts plans and orders the advertising of the work, approximately one week being required for the approval of plans and two weeks for the advertising. The clerk of the board compiles the bids and once again the job seeks publicity through an advertisement, this time for a period of one week and for the purpose of allowing the property owners to select the type of pavement they wish for their street. Should the owners neglect to designate or should they be unable to agree among themselves, another two weeks at least must be allowed for more necessary red tape to unroll. Finally a contractor must be allowed at least four weeks to assemble his plant and materials.

Now if you have been checking off the weeks on your fingers you should have arrived at the result of twelve for smooth operation and two extra for probable delays. In other words if the petition is presented early in April it will be late in June before the work is actually under way. In the meantime prices are changing and property owners are wondering, too often audibly, why such a simple job takes so long a time. The criticism might be easily overlooked if it were unattended by other evils, but the delay results in the loss of two valuable construction months and too often prolongs the work into unfavorable weather. This means financial loss to the contractor and ultimately to the city because of inferior work due to natural causes alone. Contractors experienced in city work make due allowance for this delay, and "due allowance" may always be translated into dollars and cents paid by the city for an inadequate return.

The second objectionable point concerns itself with the designating petition. In the first place the operation of this petition places the power of selecting the type of pavement to be used in the hands of the Common Council or of the property owners, while the responsibility for good construction is placed entirely on the shoulders of some official in the public works department. It is generally acknowledged that the divorce of power and responsibility is an objectionable feature in any form or phase of governmental work. Only too often this designating petition causes pavements entirely unsuited to existing conditions to be placed on streets, against the judgment and advice of officials nominally employed for the very purpose of directing and giving advice in matters of this nature. From a business standpoint it is a mistake to invest too much money in any improvement just as surely as it is a mistake to allow inadequate construction. The item of interest, however, is scarcely ever considered in a paving improvement.

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*Paper presented at the New York State Conference of Mayors and Other City Officials, Buffalo, N. Y., June 12-14.

†City Engineer, Binghamton, N. Y.

Another objectionable feature of the designating petition is the promotion work of various contractors for the purpose of securing the work for some favorite type of construction. This promotion work is undesirable even when it is carried on by methods that may be unquestionable. Such methods include the employment of lawyers or engineers to circulate the petitions and to urge people to sign for some particular type of pavement. These lawyers and engineers are paid and their compensation must come out of the taxes of the people who are paying for the pavement. If their employment were a dead loss to the contractor we would soon see the end of petition work of this sort. Unfortunately, it is very doubtful if all promotion work is at all times unquestionable. Every year we are obliged to listen to charges and counter-charges brought by this or that contractor against some over-zealous brother contractor. These charges may be true or may not be true but they certainly do not have the effect of lifting the proposition of pavement work out of the mire into which it has fallen. It would be possible for any city engineer who may be so blessed as to be working under a law similar to that which has been quoted to cite probably a score of instances that have been forced to his attention of this questionable work in connection with designating petitions. Out of these twenty examples nineteen may be false, but the mere telling of the twenty has accomplished this work.

A third objectionable feature of the designating petition, and one that in itself should be sufficient to condemn the system, is the fact that it squarely, under the guise of law, prohibits a city from applying the principles of "big business" to its paving contracts. Let us suppose that a small city is favored by having in its midst a "paving ring." In this case the designating petition is a most beautiful closed door to any outside contractor who may wish to bid in that particular city. The outside contractor would have to consider the cost of moving his plant to the new field of operation and in his bid would be compelled to make provision for this item of overhead expense. Let us suppose that the public works department of this mythical city of ours had held back the paving jobs of the city until a fairly large yardage had accumulated in the hopes that a better price might be secured for his employers, the property owners. Under the designating petition absolutely no benefit would accrue to the property owners through this accumulation of work, since an outside contractor would be compelled to add his complete overhead cost for the moving of his plant to each street on which he might submit a figure. This would be owing to the absolute uncertainty as to the yardage that might be awarded to him by the Board of Contract and Supply after the designating petitions had been received.

Briefly let us retrace for a moment our steps and tabulate the features of the system under consideration that will add to the cost of the pavement without adding anything to its value: First, the delay which necessitates work being done under unfavorable weather conditions; second, the separation of power and responsibility which is likely to result in inferior or over-expensive work; third, promotion work which is a direct charge against pavement work, and, fourth, the uncertainty of the amount of work that may be awarded with its resultant increase in overhead expense. It is, of course, impossible to place a money value on these various items, but it is undoubtedly considerable, running perhaps as high as 8 to 10% of the cost, an extremely high price to pay for red tape. Ninety per cent. of money wasted under this procedure could be saved by the simple and obvious expedient of designating the type of pavement required in the original instead of in a separate designating petition.

The habit, if municipalities have habits, of exacting uniformly from all contractors a surety bond covering the faithful completion of any undertaking is another costly luxury. If a surety bond is required under the contract it is needless to say that the contractor does not furnish this bond out of the fullness of his heart. The cost of the bond plus a reasonable percentage for annoyance is included in his bid, and the city foots the bill. It would be much simpler and also better business to allow the city official having direction of the work a proper discretion in the matter of bonds. To exact a bond from some contractor of whose financial ability and integrity there is absolutely no doubt bears a very close analogy to the burning of money.

It is possible to multiply instances of similar leaks, not only in connection with paving work but also in connection with practically every other branch of municipal activity. The correction of these is a duty that we owe to ourselves as well as to the community we serve. This constant fretting away of money in useless safeguards diminishes very appreciably the amount to be spent on necessary work and decreases the size of the tax dollar. The result is either less work or larger taxes, either of which finds its host of critics among the citizens who will not or cannot understand. If a man wishes added security for his house he secures additional locks for his doors. Needless to say he expects to pay and does pay for these locks. All this red tape thrown around city procedure is in the nature of additional locks. Unfortunately, these locks cost, but there is an unwillingness to foot the bill. The something that the taxpayer has bought is so intangible that he has not even a gilded brick with which to console himself. Seriously, the waste through this cumbersome and useless procedure is greater than we realize and right here is a patriotic duty for this organization to perform. While the farmer is making three potatoes grow where only two grew before can we not do something to simplify city business and thus bring forth a more bounteous crop from the seed of our tax dollar? Through the Bureau of Municipal Information we could pour all the plaints of the annoying little corners we would like to cut in our own city affairs into the ears of a committee appointed to find ways and means for the bringing of municipal business closer to "good" business. The amount of work that such a committee could do would be almost overwhelming but certainly invaluable.

Large Sums Provided for Oregon Road Work

Funds derived from various sources will enable the State of Oregon to carry out a well-balanced program of road construction, according to Herbert Nunn, State Highway Engineer. In addition to the state bond issue of $6,000,000 which, as noted in these columns, was passed recently by a large majority of the votes of the people, several counties have voted large sums for road improvement. These are: Tillamook County, $450,000; Douglas County, $550,000, and Grant County, $143,000.

The quarter-mill tax levied by the state and the automobile tax, together with federal aid and the bond issues will provide for the hard surfacing of all the main trunk routes throughout the state, with sufficient funds left to better the condition of the secondary and market roads.

Amendments to California's Road Laws

The work of highway improvement in California is administered under the law governing the Department of Engineering, up to the present time two road subdivisions having existed in the same department. That is, the state roads built under special appropriations of the legislature were under the immediate management of the state engineer, while the state highway work under the bond issue of 1910 was under the immediate supervision of the three appointed members of the Advisory Board, arbitrarily designated as the "state highway commission."

This law has been amended by the passage of Senate Bill No. 645, so that when it takes effect the latter part of July the three appointed members of the commission instead of composing an executive committee of the advisory board will become a statutory subdivision of the Department of Engineering. The state highway commission will then have charge of all the state highway construction under the large bond issue of the state, and state roads built under special legislative appropriations, formerly handled by the state engineer, will also be under the immediate control of the commission.

The Department of Engineering consists of an advisory board—the governor as ex-officio member and chairman, the state engineer, as chief executive officer of the department; the general superintendent of state hospitals, chairman of the State Board of Harbor Commissioners of San Francisco and three appointed members.

Section 9 of the law as amended (Section 3, S.B. No. 645) places with the department of engineering the possession and control of all roads and highways which have been declared and adopted state roads and state highways and all that may be so acquired and constructed. All expenditures by the state for highway purposes, except as otherwise provided, will be under the full charge of the Department of Engineering, and all moneys appropriated for such purpose will be made payable upon the demand of said department when approved and audited by the State Board of Control. The amendment provides that:

> The said California highway commission shall forthwith assume and have and exercise all of the powers and duties of the state engineer relating to state roads and state highways and other roads and highways heretofore by law conferred or imposed upon said state engineer, * * * and thereafter the state engineer shall have no further duty, power or responsibility with regard to roads and highways, save only such as shall devolve upon him as a member of the advisory board of the department of engineering.

Section 3 further provides that:

> The highway engineer shall be the chief executive officer of the California highway commission and shall perform such duties as may be imposed upon him by the California highway commission which are not in conflict with any duties which may be placed upon him by said advisory board.

Among the duties of the commission as set forth in Section 4 of the act is that of aiding counties or municipalities at the expense of the applicant either in whole or in part, in establishing grades and road drainage systems, and advising them as to the construction, improvement and maintenance of highways and bridges, and when deemed expedient, the commission may have plans, specifications and estimates prepared for the repair and improvement of highways and bridges, and in its discretion also act as consulting engineer for the counties or municipalities. It may accept the funds of any such political subdivision for deposit in the state treasury, to be used for the construction of roads and bridges; but it is provided that any road or bridge constructed under this section under the jurisdiction of said state department of engineering shall revert to the original jurisdiction and control immediately upon its completion, unless such bridge or road "shall, in the opinion of the commission, be and constitute an integral part of the state highway system as contemplated by the state highways act and the state highways act of 1915 or as otherwise provided by law."

The commission may call upon any state, county or municipal official to furnish any information contained in his office relating to, or which is necessary to, the performance of the work of the department of engineering and such officials must furnish such information without cost.

The commission is required to make biennial reports relating to highway work to be incorporated in the report of the state engineer to the Governor before each session of the legislature.

In cooperating with the Federal Government in matters relating to federal aid, which the state accepted by Senate Bill No. 648, the law states that "all plans, estimates and specifications shall be approved by the California Highway Commission, and the advisory board shall have full power to determine the kind, quality and extent of such work . . . . before entering into agreement with said government for such work."

A number of changes were made in the motor vehicle law of the state, some provisions of which relate to the regulation of loads and speeds of vehicles, and were designed for the protection of improved roads throughout the state.

Section 12 is as follows:

> (a) Other than on vehicles actually engaged at the time in construction or repair work on public highways, no tire on any motor or other vehicle operated on or over any public highway or bridge shall have on its periphery any block, stud, flange, cleat, ridge, bead or any other protuberance of metal or wood which projects beyond the tread or traction surface of the tire; but this section shall not be so construed as to prohibit the use of tire chains of reasonable proportions on motor vehicles when required for safety because of snow, ice or other conditions tending to cause such motor vehicle to slide or skid; provided, however, that traction engines or tractors the propulsive power of which is exerted not through wheels resting upon the ground, but by means of a flexible band or chain, known as a movable track, may be operated upon the public highways with transverse corrugations upon the periphery of said movable tracks, on condition that a permit shall first have been obtained as hereinafter in this section provided.
>
> (b) No motor or other vehicle shall be operated on or over any public highway or bridge, nor shall any object be moved over or upon any public highway or bridge on wheels, rollers, or otherwise, except when transported in or upon vehicles running exclusively on stationary rails or tracks in excess of a total weight, including load, of 30,000 lb., when said motor or other vehicle or contrivance is equipped with four wheels running on the highway, or in excess of a total weight, including load, of 40,000 lb. when said motor or other vehicle or contrivance shall be equipped with six wheels running on the highway and with three axles not less than 96 in. apart, without first obtaining a permit as hereinafter in this section provided.
>
> (c) No motor or other vehicle or other object, or contrivance for moving loads, except as hereinafter otherwise provided, shall be operated or moved upon or over any public highway or bridge, the weight of which resting upon the surface of said highway or bridge exceeds 800 lb. upon any inch of width of tire, when said vehicle is equipped with tires made of other material than metal; and no motor or other vehicle, object, or contrivance for moving loads shall be operated or moved upon or over any public highway or bridge the weight of which resting upon the surface of said highway or bridge exceeds 600 lb. upon any inch of width of tire, roller, wheel or other object supported on the surface thereof when such tires or the rolling surface of such rollers, wheels or other objects are made in whole or in part of metal, without first obtaining a permit as hereinafter in this section provided; provided, however, that traction engines or tractors the propulsive power of which is exerted not through wheels resting upon the ground but by means of a flexible band or chain, known as a movable track, shall not be subject to the foregoing limitations upon permissible weights per inch of width of tire if the portions of the movable tracks in contact with the surface of the highway

present plane surfaces; and provided, further, that cities heretofore or hereafter organized under freeholders' charters may permit or prohibit the increase, beyond the maximum weight per inch of width of tire hereinabove prescribed, of the weight of loads carried within the limits of such cities in or upon metal-tired vehicles drawn by muscular power, but where any such city has not by proper and suitable ordinance or other regulation permitted or prohibited such increase of maximum weight of loads, the regulations and limitations prescribed by this act shall not apply.

(d) No motor vehicle shall be operated or driven over any public highway or bridge drawing or having attached thereto more than two trailers; provided, that all four-wheeled trailers except light camping trailers shall be equipped with suitable brakes.

(e) Anything to the contrary herein notwithstanding, upon application in writing to the state department of engineering, said department of engineering in its discretion may issue a special permit to the owner or operator of any vehicle allowing heavier or wider loads than hereinabove in this section or elsewhere in this act permitted to be moved or carried over and on the public highways and bridges, or allowing more than two trailers to be drawn by a motor vehicle; and may also issue such special permit to increase the permissible weights per inch of width of tire, and may also permit the use of corrugations in the periphery of the movable tracks of traction engines or tractors propelled not by wheels resting upon the ground but by flexible bands or chains. Such permits shall be in writing and they may limit the time of use and operation over the particular highways and bridges which may be traversed and may contain such special conditions and provisions and require such undertaking or other security as the said department of engineering shall deem to be necessary to protect the public highways and bridges from injury, or provide indemnity for any injury resulting from such operation. All such special permits shall be carried in the vehicles to which they refer and shall upon demand be open to the inspection of any peace officer, any authorized agent of the department of engineering or of the motor vehicle department, or any officer or employee charged with the care or protection of the public highways. It shall be unlawful for any person to violate, or to cause or permit to be violated, the limitations or conditions of such special permits, and any such violation shall be deemed for all purposes to be a violation of the provisions of this act.

(f) Anything to the contrary herein notwithstanding, the state department of engineering may in its discretion limit the maximum load to be carried over or on any public bridge, causeway, viaduct, trestle or dam, below the maximum established by law; provided, however, that in such event said department of engineering shall cause suitable signs to be erected and maintained, specifying such limitation of load, such signs to be placed at a distance of not less than 100 ft. nor more than 150 ft. from the approaches to such bridge, causeway, viaduct, trestle or dam.

(g) Anything to the contrary in this act notwithstanding, the owner and the operator, driver or mover of any vehicle, object or contrivance over a public highway or bridge, shall be jointly and severally responsible for all damages which said highway or bridge may sustain as the result of so operating or driving or moving such vehicles, and the amount of such damages may be recovered in an action at law by the authorities in control of such highway or bridge.

The maximum rate of speed at which a motor vehicle may be operated on the highways of California is 30 mi. an hour excepting on highways contiguous to closely built-up territory, where the limit of speed is 20 mi. an hour, and in the business section of any incorporated city and county, or city or town, and in approaching railway grade crossings, or going around corners or curves, where the rate of speed is reduced to 15 mi. an hour. The governing bodies of the political subdivisions of the state and the counties are required within six months after the passage of the act to place and maintain warning signs at railway grade crossings on every public highway at a distance of not less than 300 ft. from such crossing and on both sides thereof.

A maximum rate of speed of vehicles over bridges and similar structures and on any highway or portion of highway may be fixed by the state highway commission at less than the regular rates whenever safety of traffic requires it, in which case suitable warning signs marking the limits of the zones calling for speed reduction must be placed not less than 100 ft. and not farther than 150 ft. from such bridge or highway.

A weight of load in excess of 9,000 lbs. including the vehicle, may not be moved upon any public highway or bridge in the state at a speed greater than 25 mi. an hour; a load in excess of 12,000 lbs., at a speed greater than 15 mi. an hour and a load weighing more than 24,000, at a speed greater than 10 mi. an hour. But no motor vehicle or trailer having tires made wholly or partly of metal may be operated on any highway or bridge faster than 6 mi. an hour; if equipped with springs and with rear wheels of not less than 46 in. diameter with a bearing surface of not less than 18 in., the vehicle may be moved at a speed up to 10 mi. an hour. Vehicles adapted for carrying loads of 4 tons or more, exclusive of vehicle, whether loaded or unloaded, are limited to 15 mi. an hour. The above provisions do not apply to vehicles equipped with pneumatic tires.

Local authorities have no power to pass ordinances or to make any rules or regulations in conflict with the limitations placed upon the rates of speed fixed by the law as above noted, but may exercise the powers already vested in them or that may be vested in them to insure the orderly use of the respective highways where the traffic is heavy and continuous, and to license and to regulate the operation of vehicles for public hire. They may impose additional restrictions upon the use of vehicles for carrying merchandise or freight of a capacity greater than one ton, or exclude heavily loaded vehicles from certain streets, and restrict or prohibit the use of trailers.

All moneys collected under the provisions of the act are deposited in the state treasury as the "motor vehicle fund." One-twentieth of the net receipts is set aside for the use of the state railroad commission in paying the state's portion of the construction, relocation, maintenance or separation of grade crossings. One-half of the remaining amount reverts to the counties in which the money was collected, and is paid into the county road funds for exclusive use in constructing and maintaining the roads. The amount remaining in the motor vehicle fund after the above deductions together with other legislative appropriations is "expended under the direction of the state department of engineering for the maintenance and improvement of state roads and highways under the jurisdiction of said department of engineering, and for the maintenance and improvement of roads and highways in state parks subject to the approval of the official or officials charged by law with the management and control of such parks." An amount, not exceeding in any year 10% of the fund, necessary for carrying out the provisions of the act is expended by the department for that purpose.

Where fines and forfeitures are collected following a violation of any of the provisions of the act and arrests of an officer of an incorporated municipality (excepting a city and county) the moneys are paid to the treasurer of the county wherein such municipality is situated and are used for road purposes. But no incorporated city and county, or city of more than 25,000 inhabitants, or "city operating under a freeholders charter and enforcing or seeking to enforce any ordinance, rule, or regulation in conflict with or covering the same or any part of the ground covered by this act, except as expressly permitted therein, shall be entitled to share in said moneys."

The Board of Supervisors of Allamakee County, Iowa, have authorized the issuance of bridge bonds amounting to $116,000.

A 6-Mi. Road Between Rushville and DeKalb, Mo., is to be hard surfaced through the use of funds obtained by popular subscription. The farmers benefited by the improvement have consented to contribute $1 for each acre of land owned by them, in many cases also donating the use of their teams on the work. Effort is being made to start the work by July 1.

GOOD ROADS

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Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

JUNE 23, 1917

COOPERATION FOR CLEAN STREETS

The public's cooperation with municipal officials is a very great factor in keeping city streets clean.

Officials and engineers engaged in street cleaning work are fully alive to this fact and most of them also realize the desirability of educational campaigns. But for some reason, possibly because the necessary funds are lacking, educational work of this nature is either neglected entirely or is carried out on too small a scale.

How a campaign of this kind was conducted successfully in the City of Philadelphia is told interestingly and convincingly in part of the 1916 report of the Bureau of Highways and Street Cleaning of that city, which is reviewed at length elsewhere in this issue. The campaign undertaken by the bureau and the semi-public bodies that worked with it is thought to have "brought to the attention of each and every citizen" the responsibility of the individual in the matter of clean streets.

The Philadelphia "clean-up campaign," as it was called, was carefully planned and was carried out in a thorough, painstaking manner. So effective did it prove that further work, the report predicts, will be "simply the enforcement of the adequate existing laws relating to clean streets, or, in other words, the performance of preventive street cleaning on the part of the citizens."

This statement is significant, for it brings out the necessity for supplementing educational work with the enforcement of the laws that apply. The report states that in Philadelphia the existing laws are adequate, and in most large cities there are ordinances which, if not adequate, are at least sufficiently extensive and inclusive so that their enforcement could be depended upon to result in a great improvement of conditions.

Street cleaning is a very important function of a municipal government—more important, in fact, than is perhaps generally realized. No small part of the work done on the streets ought to be unnecessary—and would be were ordinances relating to clean streets rigidly enforced. Other cities could follow Philadelphia's example with a gain in appearance and healthfulness, and with profit from decreased costs of street cleaning.

MILITARY COAST AND BORDER ROADS AND PRISONERS OF WAR FOR ROAD WORK?

Some six weeks ago we called attention in this column to the military advantage of seacoast and border highways and suggested the possibility of utilizing prisoners of war in road building.

As noted in last week's issue there has been introduced in Congress a bill providing for a highway on the Atlantic seaboard, across the southern border and along the Pacific Coast, with eventually a road on the northern border of the country. The bill is intended to be primarily a war measure, but at the same time its proponents take into consideration its commercial value.

Since our tentative suggestion relative to using prisoners of war, we have seen the same plan proposed several times, and, according to a recent item, a West Virginia county has filed with the Government an application for five hundred German and Austrian war prisoners for use on its roads.

So closely does the military marginal highway bill follow the suggestions made by us on May 12 that we could do no less than endorse it, as a whole. There is one point, however, upon which we differ. The bill, it is understood, provides for the construction and maintenance of the roads at the expense of the nation.

The cost, we believe, should be met in part by the Government, since the roads would be of advantage to the country as a whole, but if this provision means at the sole expense of the nation it does not seem to be wise. The states in which the roads are located will receive greater benefits from the roads, especially in time of peace, than will other states and they should be called upon to bear part of the cost.

While under present conditions the employment of prisoners of war upon roads may be a remote possibility, there are good arguments in favor of such a course. It is understood that for the duration of the war this country is expected to contribute very largely of its crops and its products to the feeding of our European allies. These allies, notably Great Britain and France, are at present burdened with the care of a very considerable number of prisoners and must, of course, use a part of their supplies for them. It would seem that we might render a very considerable service to those countries by taking care of these prisoners. If they were kept in this country it would be better from every point of view to put them at some useful work than to keep them idle in prison camps, the same arguments applying as apply to the utilization of our own civil prisoners. Road work is of greater importance than any other work upon which they could be used and they could be more easily guarded in road work than in any other occupation.

A VITAL DEFECT IN CITY STREET PAVING PRACTICE

In "Paving Contracts," a paper presented before the conference of mayors at Buffalo, N. Y., last week, City Engineer W. Earl Weller of Binghamton, N. Y., uttered a strong protest against some of the methods followed in awarding contracts for the paving of streets in New York cities of the second class. Although the paper, which is printed in full on other pages of this issue, is intended more as a protest against the mass of red tape which has to be unwound in getting street work under way and may be considered by some as a too severe arraignment of the existing laws, it describes certain undesirable conditions that obtain not only in New York, but in many other states.

Among the practices touched upon by Mr. Weller, one of the most inimical to good work at reasonable cost is the practice of allowing residents to select the type of pavement to be laid.

Under the law, which Mr. Weller quotes, a majority of the property owners owning not less than one-third of the frontage on the street, if the expense of the improvement is to be assessed upon their property, may present a petition to the Board of Contract and Supply designating the general kind of material to be used for the paving. If the property owners fail to present such a petition, or if no part of the expense is to be assessed upon the property, the designation of the kind of material lies with the Common Council.

While it may be argued that those who pay for the pavement should have the privilege of saying how their money should be spent, it must be remembered that the ownership of property abutting upon a public highway does not qualify the owner to designate the kind of pavement to be laid upon that highway. The selection of the type of pavement to be used in a given case is purely an engineering problem, as has been pointed out many times in these columns. For the same reason, the City Council should not be given unrestricted power to make such selections. In theory at least, city engineers and corresponding city officials or employees are provided for the purpose of taking care of technical matters which their employers are not fitted to take care of. In practice, however, the opinion of the engineer is too frequently either not requested or is overruled.

The results of this method of selecting pavements are apt to be disastrous. The selection made by the property owners is based upon a preference for some type of pavement which may or may not be suited to the traffic the street has to carry, or, in some cases, is made at the instignation of some interested party with material to sell. The city is then placed in the position of having employed an expert to perform certain duties and then having neglected his recommendations. The pavement if unwisely chosen often has a greater first cost than it should have, and is likely to require an undue expenditure for maintenance and to have to be replaced within a comparatively short time.

Oklahoma Makes New Laws for Road Improvement

A joint resolution was adopted by the legislature of Oklahoma and approved by the Governor in March, 1917, whereby the state availed itself of the benefits to be received from the federal aid road act and conferred upon the State Department of Highways the authority to select the projects for improvement thereunder and to cooperate fully with the Department of Agriculture in carrying out the provisions of the act. The federal appropriations to Oklahoma amount to $690,834 for the fiscal years ending June 30, 1917, 1918, and 1919, and the state will meet that sum with an equal appropriation from its treasury from funds not otherwise appropriated, available in yearly amounts corresponding to those in which Federal funds are received.

House Bill No. 620, which was approved by the Governor on March 24, 1917, makes an appropriation for the purpose of aiding the counties in road construction. Under Section 1 of the act, $1,000,000 or any available portion thereof, is set aside from any money in the state treasury for the fiscal year ending June 30, 1918, and the further sum of $1,000,000, or as much thereof as may be available, for the year ending June 30, 1919, to be used for the purpose stated above.

In order to secure state aid through funds so provided, a county acting through its board of county commissioners must first make application for such aid and agree to the terms and conditions of the act. This application must receive the approval of the Department of Highways. The money made available must be expended under the direction of the department, and the commissioner of highways is authorized to cooperate with the various boards of county commissioners in pursuing the work of state road and bridge construction.

The funds appropriated under this law are distributed among the counties on the following basis:

> one-half in the ratio which the area of each county bears to the total area of the state, and one-half in the ratio which the population of each county bears to the total population of the state, as shown by the federal census of 1910; provided, that no funds herein appropriated shall be apportioned to and made available for any county until such county shall provide by tax levy, as now provided by law or otherwise, sufficient funds to equal such state aid funds apportioned or shall have levied taxes to the maximum amount allowed by law to be levied by such county; provided further, that such fund so provided by each county, together with the moneys herein appropriated, shall be administered as provided in this act; and provided further, that for the purpose of administering the provisions of this act the commissioner of highways is hereby empowered to employ such help as may be necessary to make the surveys, plans and specifications, to supervise construction, and to perform all services incident thereto, the cost thereof to be paid by the county commissioners of the county for which such services are performed, on properly verified claims approved by the commissioner of highways; provided that in no case shall such expense exceed 3% of the funds available in pursuance of the provisions of this act.

A statement showing the division of funds as provided must be prepared by the commissioner of highways within two days after the first Monday in July, 1917, and each year thereafter, and notification of amounts due the counties given to the commissioners thereof. The commissioner is required to formulate rules and regulations for the proper administration of the state aid funds, "following as far as possible the rules and regulations now in force, as prepared by the Secretary of Agriculture of the United States for administering funds under the Federal Aid Road Act of 1916."

The selection of the projects for improvement rests with the boards of county commissioners, subject to the final approval of the Department of Highways. The counties are permitted to raise funds by bond issues, tax levies, private subscriptions, or otherwise. The highways constructed with the funds provided by the act are maintained by the counties under the supervision of the county commissioners. Should a county fail to satisfactorily maintain such a road for a period of four months, the commissioner of highways is required to direct the county commissioners of the county to put the road in proper condition within 30 days from the date of the notice. If the county commissioners fail to comply with the order further state aid to the county is withheld until the work necessary to repair the road has been done.

The state aid appropriations are subject to certain conditions and limitations which are as follows:

> The State Board of Equalization shall make an estimate of the revenue from all sources other than from an ad valorem tax, and shall add to said estimate a levy on ad valorem basis of not to exceed, for all purposes, two and one-half mills; and if said total revenues, as herein made, shall be sufficient to cover all appropriations made for said year 1917-1918 and 1918-1919, then said appropriation of $1,000,000 for each of said years shall be included in said total expenditures for said years; but if said total revenues, as estimated, are not sufficient to cover all expenditures as authorized by law, then only such portion of said sums herein appropriated shall be added to said expenditures as will make said total sum come within the limit of two and one-half mills ad valorem tax.

The provision does not limit the power of the State Board of Equalization under the state constitution and laws to levy an ad valorem tax of more than 2½ mills on taxable property for the purposes of state administration, but no additional levy may be made until the two $1,000,000 appropriations are excluded from the total estimate of expenses for state government for the fiscal years ending June 30, 1918, and June 30, 1919.

An amendment to the motor vehicle law of Oklahoma requires a manufacturer of motor vehicles desiring to do business in the state to file an annual application with the highway department, giving the name or names of the agent or agents by whom he will be represented, and other information, and to pay a fee of $15 for the above privilege. The law also requires the manufacturer to notify the department whenever a shipment of motor vehicles is made, the notification to include the serial number of each vehicle with its horse power and the name of the consignee. The consignee or agent is required to immediately notify the department of the sale of a motor vehicle, giving its serial number and the name and post office address of the purchaser.

Another amendatory act passed by the last legislature provides that in order to meet unusual expenses in cases of emergency a board of county commissioners, after the close of any fiscal year and before a levy is made for the succeeding fiscal year by the county excise board, may, with the approval of the excise board, "transfer whatever surplus balance that may exist in any county current expense fund, either in cash in the treasury or uncollected taxes, to the county road construction fund, road and bridge fund, or any other current expense fund of the county for the said current fiscal year, for which an insufficient levy and approved estimate has been made by the county excise board for the said fiscal year."

Senate Bill No. 300, which received the Governor's signature on March 26, 1917, made a part of the county road construction fund of each of the counties of the state all money then in the several county treasuries by virtue of existing laws, not claimed or paid to the taxpayers.

The authority to issue bonds "for the purpose of securing right of way and improving the public roads by drainage, grading, graveling, macadamizing and for the purchasing and building of bridges and culverts," was given the township board of directors of any township or the board of county commissioners of any county acting for such township, by an amendment to the revised statutes of Oklahoma, 1910. The bonds may not exceed 5% of the taxable property of the township. Two methods of township government are in force and recognized by the constitution of the state, and the law distinctly provides that the power of the board of county commissioners or the township board to issue bonds with the assent of the voters of the township and the approval of the attorney general, shall not be questioned.

In another brief law the board of county commissioners of any county is given authority to acquire by purchase any wagon road of concrete, dirt or plank with all bridges thereon up to 80 ft. in length, that is privately owned, at a price agreed upon by the commissioners and the owner, such price not to "exceed the actual cost of construction, plus 10% thereof," as shown by the report of a board of appraisers.

The appointment of a state engineer by the Commissioner of Highways, with the consent of the Governor, was provided for in the passage of Senate Bill No. 362, as were the appointments of an assistant state engineer and other engineers and employees. The law creating these offices also specifies the remuneration attached to the office of state highway commissioner and others. The yearly salaries are as follows:

Commissioner of Highways, $2,400; State Engineer, $2,400; Assistant State Engineer, $1,800; Assistant Engineers. $1,500; Draftsman, $1,500; Draftsman, $1,200; Cashier, Bookkeeper and Chief Clerk, $1,500 each; Rate Clerk, $1,200; Assistant Chief Clerk, $1,200; Assistant Bookkeeper and Assistant Cashier, $1,200; Assistant Rate Clerk, $1,000; Stenographers, $1,000 each; 2 Enforcement Officers, $1,000 each; Filing Clerks, $600 each. Necessary traveling expenses are allowed.

The law requires that the person appointed as state engineer shall be a "civil engineer of established reputation and qualified in road and bridge construction, hydraulic and sanitary engineering, and irrigation and drainage."

The enactment of a law relating to state roads vests in the board of county commissioners of any county in which less than 15% of the total mileage of roads has already been designated for improvement as state roads, the power to select additional highways to become a part of the state road system, provided the added mileage does not make the total mileage of state roads exceed 15% of the entire road mileage of the county. The highways are to be constructed and maintained as roads previously designated.

The use of convicts in public highway construction is in charge of the State Board of Public Affairs and the Department of Highways, the former being required to furnish complete equipment of teams, tools and machinery for each road camp on the recommendation of the department. The state furnishes a foreman or superintendent of construction for each working camp, who has charge of the work under the direction of the highway department. The state also furnishes a steward who has charge of the feeding of men and animals, who makes requisition on the State Board of Public Affairs for all food and supplies needed and for repairs and renewals of housing accommodations. His salary is paid from the state prison fund.

The commissioners of a county in which work is being done must furnish camp sites and water for men and teams without cost to the state. Housing quarters for men and equipment necessary for their custody, and accommodation for teams are paid for by the prison department. An appropriation of $100,000 is made from the state treasury for equipping road camps with proper tools and teams.

Improved Roads Save Gasoline

The economy of improved highways in the matter of lessening the cost of operating automobiles and other motor vehicles is shown by an investigation which has been made in regard to automobile travel on the post road between Austin and San Antonio, Texas.

A traffic census taken by the United States Government showed that during the month of February of this year there was a daily average of 931 cars passing over this road. This number multiplied by 30 gives an average monthly traffic of 27,930 cars, or 335,160 for a year.

Before the road was improved it required an average of 8 gal. of gasoline for the trip. This has been reduced to 5 gal.—a saving of 3 gal. per car. At 22 cents a gal. (the price at the time the census was taken), the saving on 1,005,480 gal. amounted to $221,205.60. The estimated saving on oil was $20,000, and on tires, $127,000, bringing the total saving on the three items to $368,205.60 for the year. The total cost of constructing the road was $239,800. The saving in one year, therefore, was $128,405.60 more than the cost of the road.

The results of the investigation, which was made by D. E. Colp, Secretary of the Texas Good Roads Association, assisted by experts of the United States Government, are especially interesting just now. The state law requiring a minimum license fee of $7.50 on automobiles becomes effective July 1, and it is estimated that this tax will bring into the highway fund approximately $1,360,000 annually.

One-half of the amount is returnable to the counties from which it comes, to be used for road maintenance, while all the balance, outside of 8% required for administrative purposes, will be used for road construction and maintenance by the new State Highway Department. The greater portion of the 8% referred to will be used for engineering supervision, as the commissioners do not receive salaries.

It is stated that although the new license fee may appear exorbitant by some, it will be seen that it is little more than the present fee when it is understood that it is in lieu of all city and county fees and that number plates are furnished.

Construction Progress on the Dixie Highway

The route of the Dixie Highway has been under development during the past two years, and of the 5,100 mi. contained in the system, extending from northern Michigan to southern Florida, less than 20% remains to be surfaced, and less than 10% to be graded, according to a recent statement by V. D. L. Robinson, of Cattanooga, Tenn., the secretary of the association.

The portion of the route from Detroit, Mich., to Miami, Fla., by way of Macon and Waycross, Ga., a distance of 1,536 mi., is completed with the exception of about 163 mi. to be surfaced, and 67 mi. to be constructed outright. On the Savannah route 196 mi. are unsurfaced and 50 mi. ungraded. Two hundred and twenty-nine miles of brick and cement concrete roads, 139 mi. of asphalt, 694 mi. of macadam or gravel, and 220 mi. of sand-clay have been constructed on the Detroit-Miami section, and it is expected that by the close of the year only about 30 mi. of ungraded road will remain, and that the amount to be surfaced for the first time will not exceed 75 mi. It is stated that owing to the temporary nature of sand-clay and chert surfacing, the above statement is qualified by the proviso that the counties having this type of road, properly maintain them for winter travel.

The highway between Detroit and Cincinnati was not a connected one when the Dixie route was started, and parts of it were difficult to travel. Only about 25% of the roads between Cincinnati and Chattanooga had been improved; from Chattanooga to Macon it was difficult to travel even in dry weather, and from Macon to Jacksonville a continuous trip was not possible. But the expenditure of approximately $6,000,000 on paving, grading and other construction work during the past two years on the eastern division between Detroit and Miami has made a great improvement.

Of the 263.5 mi. forming the Detroit-Cincinnati link, about 115 mi. are now paved with brick or concrete, 15 mi. with asphalt, and the remainder with macadam, rock or gravel, much of the macadam having been given a bituminous treatment. It is expected that 82.7 additional miles will be permanently improved this year.

Between Cincinnati and Richmond, Ky., it is planned to resurface practically the entire mileage of old macadam or gravel roads. Kenton County has built 8½ mi. of concrete road, and other counties will improve the rough sections of the Dixie Highway this year. A free highway bridge over the Kentucky River at the Fayette and Madison County line is proposed, and according to the report road improvement is advancing toward the Cumberland Mountains.

Between Chattanooga and Atlanta the highway is surfaced for the entire distance with the exception of 14 mi. between Calhoun and Cartersville in Gordon and Bartow Counties, Ga. Work on the Bartow County link is expected to be completed before early summer, and Gordon County has promised to make the necessary improvements. The highway from Atlanta to Macon has been designated as the first federal aid project in the state. Remaining stretches of the eastern division from Jacksonville to Miami are being surfaced so that a continuous improved road will shortly be provided for the entire distance.

Progress on the western division has steadily advanced on the 1,152 mi. between Chicago and Tallahassee. The unsurfaced distance on this division has been reduced to 141 mi. between the points named. Of the improved portion 38 mi. are of asphalt, 578 mi. of macadam, rock or gravel, 276 mi. of sand-clay or chert surfacing, and 94 mi. of brick or concrete. Rapid progress has been made on other sections of this division in Florida and Georgia, and the amount expended on the entire western division from Chicago to Miami by way of Tallahassee and Marco, a distance of 1,802 mi., with bond issues, exceeds $5,500,000.

The diversity of country traversed by the Dixie Highway has rendered road construction exceedingly difficult and expensive in many localities, notably in the isolated mountain regions of Kentucky and Tennessee and the Everglades of Florida.

Paving in Peoria County, Illinois

The road building program of Peoria County, Illinois, calls for the expenditure of $100,000 during the year. It is possible that this amount will be increased to $150,000, according to advices, if the Peoria-Canton Road is improved, for which $43,000 of state aid money has been made available.

The Mt. Hawley Road is to be constructed for a distance of 2 mi. with concrete, 15 ft. in width, at a cost of $30,794.44. The work is to be done by the Stocker Gravel & Construction Co., of Highland, Ill.

One mile of the Farmington Road will be improved with concrete at a cost of $15,048, and 2,800 ft. with monolithic brick, at a cost of $12,761.38. The former will be done by Miller & Biehl, of Peoria, and the latter by the Barnewolt Construction Co.

The Galena Road, beginning at the north line of Peoria Heights and extending northward, is being built by the Keokuk Quarry & Construction Company, of Keokuk, Ia., with concrete for a distance of 2½ mi., at a cost of $36,086.20.

The program includes the building of several bridges, but does not include work to be done by townships.

Freeing of Toll Road in Dauphin County, Pennsylvania

The County Commissioners of Dauphin County, Pennsylvania, have decided to pay half the cost of taking over the Berks and Dauphin County turnpike running from Hummelstown to Wernersville, the last stretch of toll roadway in the county. The state will pay the other half of the cost of freeing the road, after which, it is understood, permanent repairs and improvements will be completed. The road in Dauphin County extends from Hummelstown to the Lebanon County line near Palmyra.

During the last few years toll roads in the county have gradually been eliminated, and it is said that the Harrisburg Motor Club has had much to do with creating sentiment along this line. The people of this section are now urging that the Clark's Ferry Road from its present terminus at Speeceville to the Dauphin Narrows be completed. A continuation of the new highway south of Clark's Ferry bridge to the town of Dauphin along the Susquehanna River would eliminate a steep hill and several railroad grade crossings.

On June 21, according to advices received just before going to press, negotiations were concluded for the purchase of the pike in Dauphin, Lebanon and Berks counties jointly by those counties and the state.

The State of California has $101,000,000 for road improvement, for use now and in the immediate future. More than one-third of the amount is provided by the state from bond issues, while the counties supply the remainder.

MEETINGS

Calendar of Coming Meetings

June 25-27.—League of Louisiana Municipalities.—Annual convention, New Iberia, La. Secretary, Joseph B. Elam, Mansfield, La.

June 26-30.—American Society for Testing Materials.—Annual meeting, Atlantic City, N. J. Secretary, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

July 9-11.—North Carolina Good Roads Association.—Annual meeting, Asheville, N. C. Secretary, Dr. Joseph Hyde Pratt, Chapel Hill, N. C.

July 10-11.—Pikes Peak Ocean to Ocean Highway Association.—Midsummer meeting, Colorado Springs, Colo. Secretary, A. W. Henderson, Colorado Springs, Colo.

July 10-12.—Municipal League of Indiana.—Annual convention, Shelbyville, Ind. Secretary, W. S. Jones, Shelbyville, Ind.

July 12-13.—League of Michigan Municipalities.—Annual convention, Grand Rapids, Mich. Secretary, Charles A. Sink, Ann Arbor, Mich.

August 15-17.—League of Wisconsin Municipalities.—Annual convention, Racine, Wis. Secretary, Ford W. MacGregor, Madison, Wis.

August 22.—Union of New Brunswick Municipalities.—Annual convention, St. John, N. B. Secretary, James King Kelley, St. John, N. B.

August 27-29.—Union of Canadian Municipalities.—Annual convention, London, Ont. Secretary, W. D. Lighthall, K. C., Westmount, P. Q.

American City Planning Institute

At the ninth annual Conference on City Planning, held recently in Kansas City, Mo., a permanent organization to be known as the American City Planning Institute was formed. Frederick Law Olmsted was made President and Flavell Shurtleff, Secretary. Nelson P. Lewis, of New York City, and Geo. S. Webster and B. A. Haldeman, of Philadelphia, are members of the Board of Governors.

American Society for Testing Materials

A preliminary announcement of the twentieth annual meeting of the American Society for Testing Materials, to be held at the Traymore Hotel, Atlantic City, N. J., June 26 to 29, inclusive, was made in the issue of May 5. The final program has been issued and contains a number of papers and reports of interest to road builders.

The Tuesday morning session, June 26, which opens at 11 o'clock, will be devoted to business, including the reading of the minutes of the nineteenth annual meeting, the annual report of the Executive Committee, a number of committee reports, and announcement of the election of officers.

On Tuesday afternoon, at 3, among other reports and papers, there will be presented the Report of Committee E-1 on Methods of Testing, G. Lanza, Chairman; "Distribution of Pressure Through Earth Fills," by A. T. Goldbeck; "A Method for Studying the Effects of Temperature Upon the Physical Condition of Asphalt, Waxes, etc," by J. A. Capp and F. A. Hull.

On Thursday, June 28, at 10 A. M., there will be presented among others, the following papers and reports: "Determination of Absolute Viscosity by the Saybolt Universal and the Engler Viscosimeters," by Winslow H. Herschel; Report of Committee D-4 on Road Materials, L. W. Page, Chairman; "Effect of Controllable Variables on the Toughness Test for Rock," by F. H. Jackson, Jr.; "A New Consistency Tester for Viscous Liquid Bituminous Materials," by Prevost Hubbard and F. P. Pritchard.

Papers and reports on Thursday evening include the following: Report of Committee C-1 on Cement, R. S. Greenman, Chairman; "The Economical Proportions for Portland-Cement Mortars and Concretes," by J. A. Kitts; "Effect of Rate of Application of Load on the Compressive Strength of Concrete," by D. A. Abrams; "Tests of Concrete Slabs to Determine the Effect of Removing Excess Water Used in Mixing," by A. N. Johnson.

On Friday, June 29, at 10 A. M., the following will be presented: Report of Committee C-2 on Reinforced Concrete, F. E. Turneaure, Chairman; Report of Committee C-9 on Concrete and Concrete Aggregates, by S. E. Thompson, Chairman; "Tests of Concrete Road Aggregates," by J. P. Nash; "Apparent Specific Gravity of Non-Homogeneous Fine Aggregates," by A. S. Rea; "Effects of Grading of Sands and Consistency of Mix Upon the Strength of Plain and Reinforced Concrete," by L. N. Edwards.

The report of Committee C-4 on Clay and Cement Sewer Pipe, by Rudolph Hering, Chairman, and the report of Committee C-6, on Drain Tile, by A. Marston, Chairman, will be presented Friday afternoon.

The subject of miscellaneous materials is scheduled for 8 o'clock Friday evening.

NEWS NOTES

A Concrete Bridge over the South Platte River in Lincoln County, Nebraska, is to be built at a cost of $40,000, according to advice from North Platte. The structure will be 700 ft. in length, and a portion of the cost will be met by the sale of bonds.

Contracts for Street Paving in Wichita, Kan., have been awarded to an amount of $45,274.58. The total number of square yards to be paved is 16,688 and the streets to be improved are Belmont Ave., Fountain Ave., Lewis St., Waterman St., and Douglas Ave.

The State of Wisconsin Will Build 1,000 Mi. of Roads and 350 bridges this year, according to a report. The mileage does not include trunk line highways constructed with federal aid funds. The kinds of roads to be built and the mileage of each are as follows: Concrete, 65; graded, 485; gravel macadam, 320; stone macadam, 210; other types, 165.

The Michigan State Good Roads Association is behind a movement to raise by bond issue the sum of $1,500,000 for road improvement in Saginaw County, the object being to repair old roads and build new ones as connecting links and provide a finished system of trunk lines to the principal cities outside the county.

The Citizens of Bucks and Montgomery Counties, Pennsylvania, have presented a request to the State Highway Department for the freeing of the Bethlehem Turnpike, which is located on state highway Route 153. The road is 20 mi. in length, and is owned by four different companies. The chairman of the delegation making the request stated that the tolls were so heavy that farming in the community had become unprofitable, and as a result there were idle farms in the vicinity of the pike. As no change has been made by the appropriations committee of the legislature in the $500,000 asked for the freeing of turnpikes, on a 50% basis, it is expected that the Bethlehem road will be made free to the traveling public.

PERSONAL NOTES

E. B. Ulrich has been reelected City Engineer of Reading, Pa.

J. B. Wright has been appointed City Engineer of Attleboro, Mass.

Frank Petefish has been made County Engineer of Scott County, Kansas.

Anton Wandt has been appointed County Engineer of Lincoln County, Kansas.

E. G. Harris has been appointed Highway Engineer of the Special Road District of Rollo, Mo.

E. R. Gray, Deputy City Engineer of Hamilton, Ont., has been made City Engineer of that city.

F. M. Westcott will occupy the position of Park Commissioner of Syracuse, N. Y., an office created recently.

R. L. Dalton has been appointed Purchasing Agent for San Antonio, Texas, succeeding Ray M. Mackey, resigned. Mr. Dalton will assume the duties of his office July 1.

Ray M. Mackey, who has been Purchasing Agent for San Antonio, Texas, for several years, has resigned, effective July 1.

I. A. Baum has been made Assistant Manager of the La Salle Engineering Co., Chicago, Ill. Formerly Mr. Baum was City Engineer of Texarkana, Ark.

Charles A. Mead, Engineer of Bridges for the Board of Public Utility Commissioners of New Jersey, is to have charge of bridge work under the State Highway Commission.

P. A. McCarthy, of the firm of P. A. McCarthy & Sons, Lufkin, Texas, has been appointed Engineer of Shelby County in which $120,000 is being expended in building sand-clay roads.

C. D. Buck, of Wilmington, Del., has been made Chief Engineer of the Coleman du Pont Road in Delaware, a position formerly held by Charles M. Upham, now State Highway Engineer.

Howard Arrison, Assistant District Engineer of the Philadelphia Bureau of Highways, has resigned, and will become associated with Albright & Mebus, consulting and construction engineers.

Dudley T. Corning, Assistant Engineer of the Bureau of Highways and Street Cleaning, Philadelphia, Pa., has been appointed Division Engineer of the Bureau of Street Cleaning, which was recently created.

H. J. Kuelling, County Highway Commissioner, Milwaukee County, Wisconsin, will join the staff of the Wisconsin State Highway Commission as Assistant Engineer about Aug. 1, resigning his present office.

Frederick C. Dunlap, Assistant Engineer of the Transit Department, has been appointed Chief of the Bureau of Highways of Philadelphia, succeeding Wm. H. Connell, whose resignation was announced recently. Mr. Dunlap was Chief of the Water Bureau of the city for several years.

W. G. Mackendrick, President of the Warren Bituminous Paving Co., of Toronto, Ont., who has been in France during the past two years engaged in road building, has now been given the rank of Lieutenant-Colonel. He was first a captain of the Canadian Corps of Engineers and later was made Deputy Assistant Director of Roads in charge of all roads in connection with the operation of the 5th British Army in France, as major.

PUBLICATIONS

"GRAVEL ROADS" Bulletin No. 2, third edition, Michigan State Highway Department; paper 6x9 in.; 24 pp. and covers; illustrated.

This bulletin comprises a detailed description of the method of building gravel roads in Michigan. There is included a set of specifications for work of this kind. The illustrations consist of reproductions of photographs of completed roads and roads under construction, and drawings illustrating methods and equipment used in the construction of gravel roads, together with typical cross sections.

"CULVERTS," Highway Bulletin No. 3 of the Engineering Departments of Purdue University. By George E. Martin, C. E., Assistant Professor of Highway Engineering in the School of Civil Engineering, Purdue University. Paper, 6x8½ in., 22 pp.; illustrated.

This bulletin deals with the general question of constructing small culverts, without entering into the theory of the design of bridges. Beginning with the classification of waterways it presents in a non-technical form information as to location, selection of type, and the various materials used in culvert building. Suggestions regarding the use of pipe, reinforced concrete, iron, wood and stone, are accompanied by half-tone illustrations and tables of quantities and proportions of materials required, with costs.

"THE RESULTS OF PHYSICAL TESTS OF ROAD BUILDING ROCK IN 1916, INCLUDING ALL COMPRESSION TESTS," by Prevost Hubbard, Chemical Engineer, and Frank H. Jackson, Assistant Testing Engineer, Office of Public Roads and Rural Engineering, U. S. Department of Agriculture; Bulletin 537, U. S. Department of Agriculture; paper 6x9 in.; 23 pp.

This bulletin, according to an introductory statement, should be considered as a supplement to Bulletin 370 of the department in which are given the results of physical tests on samples of road building rock examined by the Office of Public Roads and Rural Engineering to Jan. 1, 1916. The bulletin consists principally of tables showing the results of tests. Table 1 shows the results of tests made from Jan. 1, 1916 to Jan. 1, 1917; table 2 shows the results of compression tests of rock made to Jan. 1, 1917; table 3 gives the geographical distribution of rock samples tested to Jan. 1, 1917, and table 4 gives the general limiting test values for broken stone.

NEWS NOTES

An Election Will Be Held in Ottawa County, Missouri, on July 12 to decide the question of a bond issue which is proposed for providing a system of improved highways throughout the county. The amount to be voted on is $400,000.

A Survey of State Highway Route No. 131 in Oxford, Chester Country, Pennsylvania, will shortly be made looking toward the improvement of the portion of the highway lying within the limits of the borough. Ten applications for state aid have been filed from Chester County.

The Governor of Pennsylvania has approved a bill providing that the county commissioners of counties having less than 800,000 population shall aid townships in the maintenance of main highways when through lack of funds the townships are unable to meet the expense of maintaining such roads.

Dade County, Florida, has recently completed the construction of twelve concrete bridges at a cost of $31,130.50. The location of the bridges are: Cutler Road across Snapper Creek; across Black Point Creek west of Goulds; Musa Isle Road across east and west forks of Miami River; Dixie Highway near Little River; flat bridge near Arch Creek; Little Arch Creek; Dixie Highway across Fulford Canal; north of Fulford across Big Snake Creek; Fulford-Ojus Road across Big Snake Creek; Fulford Canal; and west of Arch Creek across prairie. The work was done by the Luten Bridge Co.

GOOD ROADS

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Road Building in Alabama

By J. B. CONVERSE*

Alabama may be likened unto ancient Gaul in that it is divided into three parts: The Coastal Plain, the Crystalline area and the Paleozoic area. These various geological divisions have naturally influenced the type of road buildng within their confines, because limited funds in most cases have caused the engineer to use the best material available locally.

The Coastal Plain area embraces the southern half and extreme western portion of the state. Here may be found good clays, sands and Lafayette gravel, the predominating types of roads being sand-clay and gravel. The sand-clay roads are essentially light traffic roads, but for some of the southern counties of Alabama, whose road building funds are extremely limited, they have been a splendid—and the only—solution of the good roads problem. Maintenance of these roads (and it is absolutely imperative) is accomplished by dragging with a split log drag. Some of the counties have adopted the system of contracting with farmers living along the roads to drag after each rain.

STATE AID ROAD NEAR FT. PAYNE, DE KALB COUNTY, ALABAMA—CHERT SURFACE.

STATE AID ROAD IN TUSCALOOSA COUNTY — GRAVEL WITH BITUMINOUS SURFACE TREATMENT.

The Lafayette gravel which is found in many counties of the Coastal Plain area is exceptionally suitable for road construction. It consists of rounded quartzite or chert pebbles mixed with a ferruginous clay and has a high cementing value. Where available locally or where it can be procured by short ralroad shipments it is used for almost all of the roads and has proven more satisfactory than any other available material. Two splendid examples of its use are found in the road systems of Montgomery and Dallas Counties, which are constructed entirely of gravel. Although the patrol method of maintenance, with deposits of gravel placed at convenient intervals along the roadside, has not been generally adopted, it appears to be the proper answer to the maintenance problem which has become somewhat troublesome because of the increased automobile traffic.

Unforunately in some counties a system of repairs, instead of a system of maintenance, is in force. Very little bituminous surface treatment work has been done on these gravel roads. Last summer, however, the state constructed 4 mi. in Tuscaloosa County, doing the work under a specification of the Office of Public Roads and Rural Engineering. This has gone through the past winter with no repairs and is now in first-class condtion.

Next in order is the Crystalline area which covers about eight counties in the extreme eastern and central part of the state. The prevalent type of road of this section is the topsoil, which is very similar in construction to the sand-clay. The surfacing material is a gravelly loam which occurs in extensive patches on the higher lands. This section will at some future date, when finances permit, build a higher type of road, for this is a region of traps and granites well adapted to macadam construction.

The third and last area, the Paleozoic, lies in the northern and northeastern part, covering an area of about one-fourth of the state. In this region chert is used more than any other material. It is found in large quantities and in many places. Limestone is also very generally available and is used in building water bound macadam. Slag from the many blast furnaces in this section is used in road construction, generally as the base course with chert wearing surface, occasionally with limestone screenings as a binder. The experience of the state with these three types of road has demonstrated that where automobile traffic is large it is necessary to protect the surface in some manner, for otherwise maintenance will mean an annual job of reconstruction.

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*Assistant State Highway Engineer of Alabama.

W. S. KELLER,
State Highway Engineer.

J. B. CONVERSE,
Assistant State Highway Engineer.

ENGINEERS OF THE ALABAMA STATE HIGHWAY DEPARTMENT.

Not only is the state very fortunate in the distribution of road building materials, but also in climatic conditions. No such thing as a closed season for road work exists in Alabama, as the winters are so mild that construction work may be carried on during practically the entire year. The average temperature for the winter months is about 50 degrees, while the average annual rainfall is 51 in. To the locating engineer, the state offers many opportunities to display his skill, for from the swamps and marshes in parts of the extreme southern portion through the rolling lands of the central section to the Appalachian Mountains of the northern part, one will find all varieties of topography.

VIEW ON A TYPICAL UNIMPROVED ROAD IN PIKE COUNTY, ALABAMA—SHOWING DEEP SAND ROADWAY AND LACK OF DRAINAGE.

VIEW ON ALABAMA ROAD IMPROVED BY STATE AID IN TUSCALOOSA COUNTY — GRAVEL ROADWAY WITH BITUMINOUS SURFACE TREATMENT.

The local road work of the 67 counties is under the administrative control of courts of county commissioners, boards of revenue, or highway commissions. A court of county commissioners consists of four members, elected from the various districts of the county, together with the probate judge (the executive head of county affairs) who acts as chairman of the court. In counties where the governing body is known as the board of revenue, that body is similar in all respects to the court of county commissioners, except that a fifth member is elected to serve in place of the probate judge, the member receiving the largest vote being usually accorded the presidency of the board. Highway commissions exist in but few counties and are, as a rule, composed of three members, elected by the people or appointed by the governor to spend the funds of a specific bond issue. This board appoints the superintendent or county engineer, as the case may be. All counties whose road expenditures warrant it have placed their road work in the hands of experienced highway engineers with effective forces. The construction work is done by contract, organized road forces, road hands, and convicts. The law gives any county the right to work its own convicts on the roads under the jurisdiction of the court of county commissioners.

Funds for local road work are derived from direct taxation, bond issues, and warrant issues. The law provides that the court of county commissioners may levy such special taxes as it may deem necessary for the construction of public buildings, roads and bridges, not to exceed, however, one-fourth of 1% per annum. It also provides that they may transfer any surplus of the general fund of the county to the road fund. A per capita road tax of from $3 to $5 is also assessed. This tax may be worked out in all counties except Jefferson. The bonded indebtedness of counties is limited by law to 3½% of the assessed value of property. The rate of interest on bonds must not exceed 5%; bonds must not be sold for less than par value, and must run for such time as is fixed by the court of county commissioners. Warrant issues are comparatively recent innovations. In as much as commissioners' courts cannot borrow money to build roads but are given the authority by law to build roads and bridges, the Supreme Court of Alabama has held that they may issue interest bearing warrants, payable within ten years, for the construction of roads and bridges. These warrants are given to the contractor as the work progresses and he, in turn, negotiates them. As a rule they sell below par and bear a higher rate of interest than bonds. The discount on them makes the cost of the work greater, since the contractor naturally protects himself in his bid.

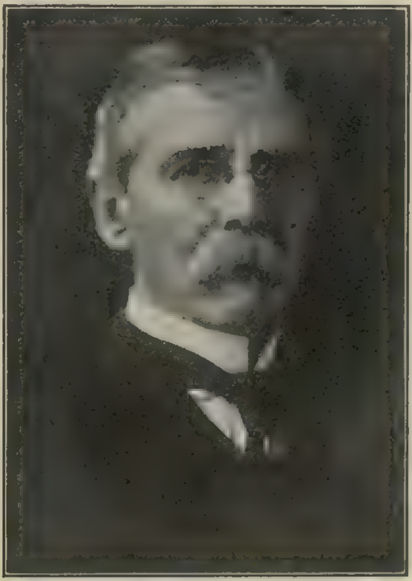
JOHN CRAFT.

ROBERT E. SPRAGINS,
Chairman.

J. B. RYLANCE.

Members of the State Highway Commission of Alabama.

G. N. MITCHAM.



E. A. SMITH.

The act of the legislature creating the State Highway Commission and providing for state aid to the counties of Alabama was passed in 1911. The commission is composed of five members—the professor of civil engineering in the Alabama Polytechnic Institute, the state geologist, and three civilians whose term of office is four years and who are appointed by the governor. They serve without remuneration. The state highway engineer, appointed by this commission and answerable to them alone, has full and complete jurisdiction over the State Highway Department. The duties of the department are not alone to construct roads and bridges, but to act in a consulting capacity, rendering all possible assistance to the counties in the matter of proper financing, building and maintaining their local roads.

The state appropriates annually to the counties $134,000, or $2,000 to each county, provided the county meets this fund with a like amount. When counties fail to avail themselves of this appropriation within two years from the date it becomes available, the money reverts to the state highway fund and is redistributed among all of the counties. The funds for state aid are derived from the earnings of the State Convict Department, as Alabama does not work the state convicts on the roads, but leases them to private interests and works them on state farms and in the state cotton mills. The expenditure of this state aid is limited to the system of trunk roads adopted by the legislature, until all state trunk roads are completed. This system embraces over 2,000 mi. of road and passes through all counties, touching 62 of the 67 county seats.

In order for a county to receive state aid, an application from the commissioners' court specifying the road to be improved and the type of construction is filed with the highway department. Embodied in this application is a sworn statement from the county treasurer to the effect that cash funds to the amount of the state appropriation have been made available by the county. After a preliminary investigation as to the eligibility of the road to receive aid, complete surveys of the proposed improvement are made by the resident engineer of the department, whose salary is paid out of the joint state and county fund. In cases where the county has a regularly employed highway engineer, he is

AN OLD COVERED WOODEN BRIDGE USED 46 YEARS AND NEW STATE AID REINFORCED CONCRETE BRIDGE TO REPLACE IT—BARBOUR COUNTY, ALABAMA.

usually deputized as resident engineer of the department for the particular work at hand. Should the county have a well organized, fully equipped road outfit, it may be used in the construction of the project, all strictly maintenance and labor bills being paid out of the joint fund. When work is done by contract, the contract is made by the court of county commissioners, advised by the state highway engineer or his assistant, and must be approved by the State Highway Commission. All labor payrolls and contractor's estimates are certified by the resident engineer and, when approved by the state highway engineer, are authority for the chairman of the court of county commissioners to check on the funds through the county treasurer in order to make payments. Not until $1,000 has been expended is the state's appropriation deposited with the county fund. Should the county fail to maintain the road after construction, all further state aid is withheld. State cooperation is not limited to roads, but may be had in the construction of steel and concrete bridges. The work is generally contracted, bids being taken on designs of the department.

STATE AID BRIDGE BUILT IN RUSSELL COUNTY, ALABAMA—FIVE 30-FT. REINFORCED CONCRETE THROUGH GIRDER SPANS.

Under this method of procedure it will be noted that all initiative lies with the county; the department having no funds or authority to proceed with any work until application for assistance is made by the county. Such being the case, Alabama will have to take advantage of federal aid by allotting this aid to the various counties as they apply for it. The state's share for the 5-year period is $1,562,238.50. There is available now $104,148.90 and on July 1 there will be an additional $208,297.80. Up to date the department has received applications from 29 counties amounting to approximately $300,000. This federal aid, like state aid, will be limited to the construction of roads forming a part of the state trunk system.

The offices of the State Highway Department are in the capitol building at Montgomery. The State Highway Commission is composed of R. E. Spragins, Chairman, Huntsville; Dr. Eugene A. Smith, Tuscaloosa; Prof. G. N. Mitcham, Auburn; Captain John Craft, Mobile, and J. B. Rylance, Montgomery. The State Highway Engineer is W. S. Keller, and the writer is Assistant State Highway Engineer.

Engineering and Clerical Force Appointed by West Virginia Highway Commission.

The following appointments have been made by the state highway commissioners of West Virginia as members of the engineering or office forces of the commission:

Rolland P. Davis, Bridge Engineer; Charles G. McCoy, Chief Clerk; Edward Bennett, Testing Engineer; Robert Duncan, Statistical Engineer; L. L. Jemison, Chief Draftsman; David G. Lilly, Clerk, Automobile License Department.

The headquarters of the state highway commission will be in Charleston, instead of Morgantown, where the Road Bureah was formerly located.

Highway Work to Be Let in Pennsylvania Counties

Bids for road work in Beaver, McKean, Armstrong and Somerset Counties, Pennsylvania, are to be opened at the office of the State Highway Department at Harrisburg on July 24.

The road to be improved in Beaver County extends from Monaca to Aliquippa, in Moon and Hopewell Townships, the length of the proposed improvement being 9,299 ft. and the width 14 to 16 ft.; type of construction, vitrified block and water bound macadam. This is a state aid road, Application Nos. 254 and 294.

The highway to be improved in Armstrong County also is a state aid road, Application No. 397. It is located in Manor Township, extending from Ford City to Kittanning. It is 13,007 ft. in length, and is to be 16 ft. wide; type of construction, vitrified block.

In McKean County the proposed improvement is located on State Highway Route 96, in Foster Township, and extends from Bradford to the New York State line. The pavement is to be 8,367 ft. long and 16 ft. wide; type of construction, vitrified block.

In Somerset County the work consists of grading and draining 20,109 lin. ft. of road bed 26 ft. wide, located in Summit Township on State Highway Route 51, extending from Garrett to Meyersdale.

McKean and Somerset Counties will each pay one-half of the cost of the proposed work.

The Improvement of the Highway from Charleston to Columbia, S. C., is advocated as a military measure by the Charleston Chamber of Commerce. It is desired to secure the cooperation of the several counties through which the road passes in providing a modern highway for the entire distance.

Traffic Regulations*

By HENRY JAY CASE†

Traffic regulation today is more than a uniformed policeman with a whistle in his hand or a stop-and-go semaphore on the street corner. Regulations, policemen and the whole stanchion equipment count for nothing if public cooperation is lacking; and to get this cooperation of the public, traffic regulations must be simply worded. They must be understood by the people, and the policeman enforcing them must also be understood by the people.

Therefore, in earnest, painstaking efforts to teach the public what these rules mean, what their objects are, and how much they will benefit the people—in educational work such as this—lies the success or failure of a system of traffic regulation.

The time has long since gone by when a police force can make the public bow to traffic regulation by use of the night stick. Legislatures and legislation won't do it. You can't legislate carelessness out of people. You can't, by making laws, stop a man from being reckless or negligent. You can sit in your councils and pass traffic rules all night, but that won't stop people from running in front of an automobile nor automobiles from running over people. To try and save them you have got to win their interest and attention, and in order to win their interest and attention you have got to go before them as a teacher.

In New York City, the police commissioner comes in contact with the citizen, not as a belligerent, but as a friend and helper; he sets the stage for the law's enforcement in a peaceful manner.

To get the best results in this new line of police work, pick and choose your traffic officers carefully. It is no place for a surly man. Unless the traffic officer can take his job good-naturedly, it will go hard with him. He will need every ounce of good nature in his system to hold down this job because no man can pack a grouch for nine hours and be of any use to any one.

The average foot patrolman deals with about twenty persons a day. The traffic officer personally comes in contact with a thousand. Therefore, pick "Sunny Jim" for your traffic officer; take off "Groucho the Monk."

The traffic man is put on post in New York to use his head as well as his whistle and his smile. He is encouraged to observe and to make suggestions.

Here is a classification of operators made by New York policemen. Maybe you will find yourself in the catalogue:

1. The Owner Who Drives.—Generally operates his own car; seems to believe in the golden rule; is intelligent, thoughtful, and anxious to obey regulations; has regard for the safety of those who walk, as well as that of himself and those riding with him; is easy to handle; knows that if he violates traffic rules he himself is responsible, not only in a criminal court, but in a civil court as well. In short, we like to deal with the owner who drives his own car, and wish there were more of him.

2. The Owner Who Employs a Chauffeur.—Always has money enough to pay his chauffeur's fines; is generally in a hurry; doesn't start from home until the last minute and then frequently takes a chance of violating the law so as to "get there" on time; never doubts his chauffeur's ability to get anywhere within the time available, no matter how impossible the task.

3. The Private Chauffeur.—Depends upon his employer's ability and willingness to pay all fines and damages, or his employer's influence with "the powers that be," whatever that may mean, which confidence makes him indifferent to the rights of everyone, except his employer and himself; is supremely content in the knowledge that if he violates any traffic regulation his fines will be paid, and if he injures any one or anything his employer will relieve him of responsibility in a civil suit.

4. The Ex-Coachman Chauffeur.—Usually comes from the box of his employer's victoria or landau, is generally of middle age, has a family, is settled in life and thoroughly familiar with traffic regulations by reason of having driven horse-drawn vehicles; almost without exception drives his automobile in a careful and prudent manner; is seldom seen in court to answer a complaint made against him by a traffic policeman.

5. The Commercial Chauffeur.—Generally operates vehicles of high tonnage, his occupation taking him to all parts of the city and into localities where there are no traffic policemen; his vehicle, not geared for speed and generally heavily laden and cumbersome, becomes a most dangerous weapon in the hands of a careless or incompetent operator; owner generally carries accident insurance, for the reason that when persons are run over or struck the results are not infrequently fatal. Police officers of experience in handling traffic, knowing the great weight and size of these commercial vehicles, and notwithstanding the fact that many of them are equipped with governors to regulate their speed, believe that the average driver operating this type of motor truck does not have a control of it commensurate with its possibilities of destroying human life.

6. The Taxi Chauffeur.—Ready at almost any time, in return for a small tip, to take a chance to accommodate a passenger; is out for the money, and in many cases doesn't care how he obtains it; doesn't welcome police regulations; is not over-solicitous of the rights of others; and the type is perhaps the worst source of trouble to policemen.

7. The New and Inexperienced Chauffeur.—Although many have good judgment, and ultimately become proficient in driving their cars, the largest percentage of them, while still wholly incompetent, venture into congested sections of the city, creating bad tangles, causing delay, and, not infrequently, most hazardous situations.

For pedestrians, the following is a fair classification by traffic policemen:

1. The woman shopper who risks her life crossing the street to save five seconds and then wastes twenty-five times that at the very first shop window.

2. The independent citizen who deliberately walks into the midst of fast moving traffic and defies any driver to run over him.

3. The newspaper reader who believes the middle of the street is a reading room and acts accordingly.

4. The adventurous small boy who prefers to bicycle or roller skate on heavy traffic streets rather than on play streets set aside for him.

5. Boys and girls who play tag in and out of swift moving traffic.

6. The average, every-day, law-abiding citizen, who is always willing to do what is right, and through that willingness is invariably imposed upon by drivers.

New York City has 700 policemen in the traffic division, and in this an increasingly large number of Sunny Jims. But to piece out this man-power, the department has to use a number of devices. Some of them are:

1. Safety Isles.—These spaces, usually diamond shaped, are marked off with traffic stanchions. The isles are usually 30 ft. long by 8 ft. wide, placed in the center of roadways,

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*Paper presented at the New York State Conference of Mayors and Other City Officials, Buffalo, N. Y., June 12-14, 1917.

†Secretary to the Police Commissioner, Police Department, City of New York.

at street intersections, and at locations where traffic is not heavy enough to necessitate the stationing of a traffic officer. They provide a refuge for pedestrians crossing the street and divide traffic by keeping vehicles to the right and require people to walk in one direction and necessitate their looking in only one direction.

2. Car Stop Safety Zones.—These spaces are formed by traffic stanchions placed on roadways having surface car tracks, particularly at transfer points. These zones add greatly to the safety of persons waiting to board or alight from cars and at the same time permit vehicles to keep moving. They also save time in the operation of the cars.

3. Keep to the Right Signs.—These are placed at street intersections where traffic is light but where regulation is necessary to compel drivers to keep to the right and not to cut crossings short.

4. Semaphore System.—This is known as the 5-block system and is today in effect only on Fifth Ave. between 26th and 58th Sts. The avenue between these two streets is divided into zones, a semaphore being located at each street intersection. Each zone is controlled from the master stanchion, the operator of which, under ordinary circumstances, permits north and south traffic to proceed over a period of about one minute and forty seconds. When the man at the master stanchion turns his semaphore to permit traffic to proceed north and south on the avenue, the man at each of the other semaphores instantly turns his semaphore to allow traffic to proceed north and south.

When the man at the master stanchion signals for east and west bound traffic to move, the other men at the other stanchions in this zone do likewise unless there is no east and west traffic waiting, in which case they leave their stanchions set for north and south. The master semaphore when set to allow crosstown, or east and west, traffic to proceed, is usually set in this position from forty to fifty seconds.

The one binding thing in this regulation is that when the master stanchion is set for traffic to proceed north and south on the avenue, all of the other semaphores within the zone are likewise set.

In order to work this system it has been found necessary to adopt the following regulations:

Vehicles proceeding north or south on Fifth Ave. and desiring to turn left into side streets must (1) either turn right and go around the block, or (2) form a line in the center of the roadway back of the crosswalk, wait for the officer's signal and then pass in front, instead of around the semaphore stanchion.

The officer is to give his signal for such vehicles to turn into side streets when a break in the north and south bound traffic occurs. This is in order that the turn may not interfere with north and south bound traffic.

When there is no break in north or south bound traffic while vehicles are lined in the center of the roadway, waiting to turn left, such vehicles turn left into side streets when east and west traffic is signalled to proceed, taking the head of the line by making a short turn to the left.

In addition, when north and south traffic is proceeding, but is light, and conditions warrant, the officer signals by hand for vehicles in the side streets to proceed in the line of traffic.

5. One Way Streets.—These are usually narrow ones where traffic is heavy and the blocks are not long. There are 44 at present, movement of traffic being greatly facilitated and pedestrians having only one line of traffic to watch in crossing streets.

6. Parking Spaces.—Besides the spaces regularly set aside by the police commissioner in Manhattan, vehicles are permitted to stand at the curb providing they do not obstruct traffic. There are no set rules for parking privileges, traffic conditions wholly governing.

7. Slow Moving Vehicles Keep to the Right.—By compelling slow moving vehicles to hug the right hand curb and keeping obstructions from the roadway, thoroughfares are kept cleaner and safer for drivers and pedestrians. Vehicles backed up to the curb, except while actually loading or unloading, are strictly prohibited.

8. Playground Streets.—During certain hours of the day, usually 3 to 6 p. m., vehicles are prohibited from passing through certain streets in the congested part of the city, officers being detailed to enforce this regulation and to protect children who are directed to these streets to play, safely removed from the danger of being run down by fast moving vehicles.

9. Backyard Playgrounds.—By cooperating with the owners of property many of the interior courts of the larger blocks in the congested districts have been transformed into playgrounds by tearing down the fences, grading the areas, and erecting playground apparatus. Only children living in the houses facing the yards are permitted in these yards and attendants are assigned to supervise and direct the games. This is another successful means of drawing children off the streets and away from the dangerous street accidents.

10. School Streets.—To further safeguard children, school street signs, during school hours, have been placed in front and at the intersection of streets where public schools are located. These warn drivers to go slow and to look out for children at play.

When "Groucho the Monk" was the traffic policeman the number of arrests in a day was his batting average. With "Sunny Jim" at work today summonses and arrests are avoided wherever possible. Don't mistake this as an invitation to come to town and break traffic regulations. The traffic officer does not serve summonses and make arrests for traffic violations today if there be any reasonable doubt. Summonses and arrests take policemen off the streets where they are rendering service and keep them in court.

Instead of summonses and arrests, in doubtful cases drivers are served with a warning and this warning is promptly recorded at Headquarters. If the same driver is again found breaking a traffic regulation he receives a second warning. This warning goes to Headquarters, where it automatically, in the card index system, finds the first warning. If the driver receives a third warning it automatically finds the second and a summons for his appearance in court immediately issues. The magistrate disposes of this third offense upon the evidence which relates to that particular offense. If the person be convicted, the magistrate is then furnished with a record of warning No. 1 and warning No. 2, and in passing sentence upon the third offense he considers the facts in offense No. 1 and offense No. 2.

So thoroughly do I believe in the effectiveness of a system of warnings as applied to this class of cases that I wish to dwell for a moment upon this subject.

To repeat, a traffic policeman standing in the middle of the street using his hands is of more value than he is when sitting in court with his hands in his pockets waiting for the disposition of his case.

Let me liken a traffic policeman on duty to a monitor or a teacher in a school. If the teacher was always engaged in corporal punishment there would be little time for maintaining order in the room. The issuing of a summons by a police officer might be likened to the administering of corporal punishment by a teacher. Summonses, like corporal punishment, must only be inflicted when the case is urgent. This is not a beautifully spun theory. Like all practices, it was theory once. Every castle is built in the air before it is built on earth. I am glad to say that four months' experience with the warning system, as I have outlined it, has proved its worth beyond the shadow of a doubt.

When an administrative power exercises clemency it must

(Continued on page 384)

GOOD ROADS

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Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

JUNE 30, 1917

MACHINERY TO OVERCOME THE LABOR SHORTAGE

Continued activity in road building during the war—in fact, increased activity—is quite generally recognized as necessary, we believe. There is also evident a determination in most localities to exert every effort to prevent the present situation from bringing about any let up in the construction and maintenance of the roads necessary to the commerce and industry of peace as well as war time and to the successful conduct of military operations should the necessity arise.

In the months to come, however, the difficulties that have hindered road builders for some time past are likely to grow to considerable proportions—to such proportions, indeed, that contractors will have to exercise all their ingenuity to surmount the obstacles they will find in their way. One of the most troublesome matters will be the securing of the necessary labor forces. Laborers have been hard to find for some time and as the military establishments of the allied countries make ever increasing demands, the available supply will naturally continue to decrease.

The use of prisoners of war has been suggested in these columns and has met with approval in various quarters It is possible that the plan will be put into effect, but it can not be counted on at present nor, even if put into practice, can it alone be expected to solve the problem. Other means must be found and found quickly.

The obvious solution of the problem, and probably the best one, lies in the greater utilization of labor saving machinery. For a long time manufacturers have been getting out new machines and improving existing equipment until now there is available a large and varied line of road building machinery for the contractor's use. Practically all of this equipment is designed to save labor, time and money.

More and more of it is being used all the time but there is still the possibility of a greater use. Certain machines such as the road roller, the distributor and the concrete mixer are in almost universal use. Others like the motor truck are becoming more and more common on road jobs. Still others such as the steam shovel are used extensively, but not so commonly as they might be. Besides these there are others that have great possibilities as labor savers but are in less general use. A few are conveyors, tamping machines and loaders. There are others, but these will suffice to illustrate the point.

With labor constantly becoming harder to obtain, more costly and, incidentally, less efficient, the wide-awake contractor will utilize to the maximum the savings made possible by more extensive equipment.

TRAFFIC REGULATION

To anyone familiar with traffic conditions on some of the busiest city streets the remarkable feature is not that there are accidents but that the accidents are so few. Both those who have to deal with the traffic congestion as officials and those who sometimes feel that they are inconvenienced by traffic rules will find much of interest in the paper on "Traffic Regulation," printed elsewhere in this issue.

The perfect system of traffic regulation has yet to be devised, but rapid strides have been made during the past few years in many cities where the rapidly changing traffic conditions have necessitated better methods in order to avoid hopeless confusion. New York is typical of cities of this kind and Fifth Avenue is one of the streets where effective regulation is absolutely essential. The plans that have been devised and put into operation on that thoroughfare are described in detail in the paper to which reference has been made. Further improvement is possible in this particular case, but the system evolved represents a number of steps in the right direction and merits careful study.

Traffic regulation is more a police problem than a road builder's problem, but since the possibilities in regulation depends so much upon the design of the individual street and of the city plan, it is a matter that must be considered by engineers engaged in city street work. It is seldom that the engineer has an opportunity to lay out a street plan of any considerable magnitude but he is often called upon to devise means for so altering existing layouts as to better provide for increasing traffic. In such cases the regulating of traffic on the streets to be provided must be taken into account in the design. The same thing is true of widening operations, the treatment of intersection and many other problems encountered in city practice. For these reasons traffic regulation must be given a place among the numerous matters with which the modern highway engineer must acquaint himself.

The Paving of Gay and Other Important Streets in Baltimore, Md., will be completed by Aug. 1, according to a statement by the Paving Commission.

The Blaine-Ferndale Road in Whatcom County, Washington, is to be improved at a cost of $123,566.50. A contract for the work has been awarded to Lindenham & Cooper, of Vancouver, B. C.

Whether or Not a Petitioner May Withdraw His Name from a petition for road improvement is a question recently decided by the Circuit Court of Henry County, Indiana. The matter arose over the paving of 3 mi. of the National Road, east of Greenfield, Ind., with brick. A case was brought in Hancock County, but was transferred to Henry County, where the court decided that a signature to a petition could not be withdrawn after it had been filed with the auditor. The case attracted more than local interest and was watched by contractors and others interested in public improvements.

Improvement of Roads in Military Reservation at Mount Gretna, Pennsylvania

The construction of 6½ mi. of roads in the military reservation at Mount Gretna, Pa., has been ordered by Adjutant General Thomas J. Stewart, and the work is now under way, according to a report from the Pennsylvania State Highway Commissioner, Frank B. Black. Construction operations will be rushed so that the roads may be in first-class shape for the mobilization of the National Guard. The officials of the National Guard will establish a large commissary department at the camp. It is stated that every resource of the State Highway Department necessary for the early completion of the roads will be made available.

Additional Data on the Effect of the War Upon 1917 Road Work

In previous issues there appeared a series of articles dealing with the probable effects of the war upon road work in the various states. In order to get this matter before our readers as soon as possible the reports were printed as they came in and as space was available, without waiting for complete returns. In the following paragraphs are reports from states which have replied since going to press with the last of the series.

Colorado

The total amount of state funds available for 1917, according to Chief Engineer J. E. Maloney of the State Highway Commission, is about $700,000. This will be met by an equal amount from county funds. Approximately one-half of the entire amount will be used for construction, the remainder being used for maintenance. The expenditures for 1917 will be about the same as those in 1916.

In addition to the above, Mr. Maloney reports in part as follows:

"The entrance of the United States into the war will have no appreciable effect upon the road work this season except as it affects the labor conditions. The rate of wages for both common and skilled labor has increased, and team hire is now from $5.50 to $7.00 per day for eight hours of work, in different sections of the state. Day labor runs from 30 to 37½c. per hour, and state work is generally on an eight hour basis."

North Carolina.

State Highway Engineer, W. S. Fallis of North Carolina reports in part as follows:

"Our commission is merely an advisory commission so far as the expenditure of money is concerned. Our state does not furnish us any direct funds for road construction. These funds are furnished by the counties and townships, independent of the state, and only a small proportion of the funds thus provided are even reported to the State Highway Commission. You will, therefore, see that it is practically impossible for me to give you a definite answer to either one of your questions.

"From such information as I have, however, the only effect that is apparent on account of the war is the scarcity of labor and the increased cost of the work. This, of course, will to a considerable extent prevent new work. In many cases, however, where bonds have already been authorized and the work is under way it will only affect the amount of actual construction done and will not affect the expenditure therefor."

West Virginia.

Chairman A. D. Williams of the West Virginia State Road Commission reports in part as follows:

"We have been hampered materially in a number of ways, first, by confusion in the shipment of materials, second by the scarcity of labor and, third, by the nervousness of contractors, who fear to bid not knowing what the outcome may be. Much of our work this year is being done on a percentage basis and by day labor. We are meeting the situation as best we can and go forward."

Utah Road Projects

Steps have been taken by the State Road Commission of Utah toward utilizing the federal and state appropriations available for a 5-year period, amounting to $1,708,504.50. The projects to be started this year comprise a mileage of 264, and it is stated that the available funds will provide for an expenditure of $1,200 a mi. for gravel and other surfacing, and $12,000 a mi. for concrete. The total estimated cost of improvement for the 5-year period is $1,704,000.

The highways, five in number, are the road from Castle Gate to Duchesne, 44 mi.; from Thompsons to Blanding, 132 mi.; Ogden to Hooper, 10 mi.; Beaver to Milford, 33 mi.; and Tremonton to Snowville, 45 mi. The construction of the proposed roads will proceed in the order of their importance, and will be started as soon as approved by the federal representative. It is believed that some of the roads may be completed by next fall.

Utah's annual apportionment from the government on account of national forest roads will be $40,000 or more. The highways designated for improvement under agreement with the government have a total length of approximately 130 mi., as follows: Logan to Garden City, 40 mi.; Ephraim to Orangeville, 40 mi.; and Cedar City to Long Valley, 47 mi. Their estimated cost is $202,000.

Covert Law Sustained in Michigan

The Covert law, passed in Michigan two years ago, which permits the levying of assessments for road improvement, has been declared constitutional by Judge Houghton, of Bay County, following mandamus proceedings brought against the county road commissioners. The legality of bond issues amounting to more than a million dollars has been questioned.

In his opinion Judge Houghton said, in part:

> While it does not appear on the record it is nevertheless a well known fact that considerable progress in the improvement of highways has been made under the highway laws of 1915. Bonds have been issued and sold and improvements made, and except in a strong case where injustice is sure to follow the proper administration of the operations of the highway law, they should be sustained.
>
> The drain law, from which the highway law is prepared, has been sustained on the theory of the benefit of public health, which must be on the theory that drainage prevents the accumulation of and removes that which is conducive to disease, in other words, a preventative.
>
> It is not stretching the imagination very far along the same line to say that public roads are a necessity, not only for convenience, but for public health. While drains are designed to remove the cause, highways afford an opportunity for elimination by furnishing to the public the opportunity of receiving and applying scientific aid, which, without means of communication, could not be had.

Federal Aid Projects in Minnesota

Three projects, comprising a total of 103 mi. of highway, have been approved by the Secretary of Agriculture. The combined federal and state appropriations for the improvement amount to $316,200. The highways to be improved are located as follows:

Between Rush City and Sturgeon Lake, 50 mi., estimated cost, $160,000; between Forest City and Rush City, 32 mi., estimated cost, $110,000; in Freeborn County, to complete state road No. 1, between Owatonna and Albert Lea, 21 mi. It is expected that work on the roads will begin by fall.

The New Highway Officials of Missouri

The new Highway Board of Missouri consists of E. L. Sanford, Chairman; George E. McIninch, Vice Chairman; A. Campbell McKibben, Secretary, and C. O. Raine. The appointment of these men by Governor Gardner, under the terms of the so-called Hawes Road Bill passed by the 1917 Legislature, was noted in a previous issue of "Good Roads." Alexander W. Graham was appointed State Highway Engineer, as noted in the issue of April 7, and J. P. Davis and J. Russell Ellis were appointed assistant engineers.

E. L. SANFORD,
Chairman, Highway Board.

GEORGE E. McININCH,
Vice Chairman, Highway Board.

Principal Officials of the Missouri State Highway Department.

A. CAMPBELL McKIBBIN,
Secretary, Highway Board.

ALEXANDER W. GRAHAM,
State Highway Engineer.

C. O. RAINE,
Member, Highway Board.

E. L. Sanford, Chairman of the Highway Board, is an influential business man of Springfield and has been engaged in banking and manufacturing for a number of years. He has been a leader in the good roads movement in southeastern Missouri and a director of the Ozark Trails Association and has helped to develop for this city and the surrounding country an extensive system of improved highways. Realizing the importance of a military road from St. Louis by way of Springfield to Joplin, passing through the great lead and zinc producing section of the country, he has been in conference with the war department and is working for the development of this proposed highway.

George E. McIninch, Vice Chairman of the board, was born in St. Joseph in 1867. During the early years of his life he was associated with his father in the conduct of a general store. For fourteen years he was engaged in the wholesale china and glassware business. For about 15 years past he has been secretary of the Combe Printing Co., of St. Joseph. Mr. McIninch first became interested in roads some six or seven years ago and has served as treasurer and later as president of the Automobile Club of St. Joseph. He has also been actively identified with the work of the Pikes Peak Ocean to Ocean Highway Association and the Jefferson Highway Association. During the past two years he has served as president of the St. Joseph and Buchanan County Good Roads Association.

A. Campbell McKibbin, Secretary of the board, is a former newspaper and publicity man, and became interested in road work through handling publicity campaigns for road and bridge bonds in various parts of Missouri. In one case the success of a $3,000,000 bond issue campaign was very generally attributed to his ability. As secretary of the Federated Road Associations of Missouri Mr. McKibbin rendered valuable assistance to H. B. Hawes in the preparation of the Hawes Road Bill which created the present organization.

C. O. Raine of Canton has been Master of the Missouri State Grange for the past fifteen years and has always taken an active part in public improvement work in rural communities in the state. Mr. Raine was a member of the Committee on Resolutions of the National Grange which took an active part in working for federal aid in road building. He was recently appointed a member of the Missouri Council of Defense and has always been a strong advocate of the improvement of market roads.

Alexander W. Graham, State Highway Engineer, received his education in the public schools, the William Jewell College and the University of Missouri, receiving the degree of B. S. in C. E. from th latter institution. For several years Mr. Graham was a field engineer for Waddell & Harrington of Kansas City, acting during that period as assistant resident engineer and resident engineer on some of the largest bridges built in the Middle West. Among these structures were two bridges over the Mississippi at Keithsburg, Ill., built for the Iowa Central Railroad, the Armour-Swift-Burlington Bridge at Kansas City, Mo., and the Great Northern Railroad Bridge over the Yellowstone River at Fairview, Mont. More recently Mr. Graham was connected with the Highway Department of Jackson County, Mo., and for some time was Chief Engineer of the Kansas City Park Board.

Traffic Regulations

(Continued from page 380)

inflict a rigorous punishment when the clemency is not accepted by the public in a proper spirit, and so, when a sympathetic magistrate finds that the public will not meet the forces of law and order at least half way the magistrate must go seven-eighths of the way to meet the offender. In other words, he must fine him severely or imprison him. If you attempt to become lenient under certain conditions, without becoming rigidly severe under certain other conditions, you will bring the administration of law into contempt and make of yourselves what an American statesman once called a mollycoddle.

A man once warned is always told that should he conduct himself carefully and escape a second or a third warning, the first warning will not result in any punishment.

For something more than three years the Traffic Division of the New York Police Department has been under the active direction of Inspector Thomas Myers. Many of the methods referred to in this paper originated with him and his officers and men, and to them should be given a great amount of credit for what has been accomplished in the traffic regulations of the city.

Should any of you be sufficiently interested in this subject to find out in detail just how our system of warnings is kept, I should be very glad to send you personally a brief treatise on this subject upon request.

But warnings, safety zones, one-way streets, play streets, and car stops are only a part of this traffic regulation as the New York Police Department sees it. By talks, moving pictures, lantern slides and newspaper publicity, Commissioner Woods has tried to keep the dangers of street accidents and the value of traffic regulations constantly before the public. The campaign of education as he has carried it on is roughly as follows.

Police sergeants have been assigned to talk in the various garages and stables to drivers and chauffeurs. They base their appeal to these men on the assistance the police can render in protecting the property in their care, asking for cooperation and appealing to them to exercise care and judgment in protecting the pedestrians.

Police sergeants are sent to the public schools to talk to children on how to avoid street accidents.

The department distributes lantern slides illustrating the common causes of street accidents and how to avoid them. These slides are displayed throughout the city.

A year ago, the police commissioner asked the aid of the Advertising Club of New York in a publicity campaign on traffic regulation and street accidents, and the club in response gave the department a group of experts in about every line of advertising. With a wealth of suggestions and illuminating statistics, many of the suggestions having been contributed by members and officers of the force, this advertising committee with a representative of the department worked out a campaign which included the use of about every possible publicity medium for bringing facts and figures to public attention.

The whole campaign was based on a colored picture of a careless driver, an officer carrying an injured child away in his arms, and a line directing the public to ask a policeman for a safety booklet. With this as a trademark of the campaign, the town was placarded—in store windows, elevated, subway and street car lines, public schools and other places. There were issued 50,000 of these cards, and approximately 500,000 of the safety booklets were given out by officers on post. Stereopticon slides carried the picture into every moving picture house in the city and the film companies further cooperated by making moving pictures illustrating the warnings and advice given in the police safety booklet. Advertising companies painted the police warnings on conspicuous out-of-door signs throughout the city. Merchants came into the campaign by carrying the warning captions and headlines in the reading matter of their paid advertisements in the newspapers.

Never before in the history of the department has any such attempt been made to reach the people by such an appeal, and never before did members of the force come in such direct personal contact with an appeal that made so many friends for the force. This is proof, in my mind, that not only can the public and police cooperate in good police work, but that such cooperation is necessary and essential to good government.

In conclusion, then, traffic regulation is something which demands the cooperation of the public with the police, and in the working out of an effective system the rights of both the pedestrian and the driver must be kept in mind.

Drivers have a right to expect:

1. That all persons be prevented from hooking on behind vehicles, or stealing rides on trolley cars.
2. That pedestrians do not cross heavy traffic streets at other places than regular street crossings.
3. That persons crossing streets do not carry umbrellas or bundles so as to obstruct their view.
4. That persons do not read newspapers while crossing the street.
5. That persons walk on the sidewalk instead of in the roadway.
6. That persons in crossing streets keep their eyes open.
7. That passengers do not alight from street cars in motion.

Pedestrians have a right to expect:

1. That drivers refrain from speedy and reckless driving.
2. That drivers refrain from operating vehicles with faulty steering gear, without adequate brakes or sound signals, without lights or with dazzling lights.
3. That drivers do not operate vehicles while intoxicated.
4. That drivers of vehicles give the proper signals when about to stop.
5. That drivers do not pass or approach within 8 ft. of a surface car which is stopped to discharge or receive passengers.
6. That drivers keep to the right.
7. That drivers in passing overtaken vehicles, except street cars, keep to the left.
8. That drivers keep to the right of car-stop safety zones, safety isles, etc.
9. That drivers exercise proper precautions in approaching street intersections.

10. That drivers do not leave horses unbridled or unattended on the streets.

11. That drivers do not leave vehicles along the streets without brakes properly set.

12. That drivers hold the reins properly in their hands and keep their eyes open.

Both drivers and pedestrians have a right to expect:

1. Laws that shall insure safety and as rapid progress of vehicles as is consistent with safety.

2. That no driver be permitted to operate unless he is competent to do so.

3. That a speedy or reckless driver be promptly summoned or arrested.

4. That the number of the car of such driver be taken and properly reported if the officer is unable to apprehend the driver.

5. That in every accident a list of proper witnesses be taken.

6. That every driver charged with intoxication be immediately examined by a police or ambulance surgeon as to his condition.

7. That patrolmen on post notify the owners of garages and stables of measures being taken by the police to prevent accidents.

8. That in each accident, however trivial, the police officer on post be particular to examine the brakes and steering apparatus and report on it.

County Road Tax Law Enacted in Kentucky

At the extraordinary session of the general assembly of the State of Kentucky, 1917, an act was passed for the purpose of raising revenue for constructing and otherwise improving the highways and bridges of the counties. Taxation is the method provided for producing such revenue, the law being, in part, as follows:

> Section 1. The fiscal court of any county of the state may submit to the voters at a special election to be held for that purpose, the question of voting a tax of any sum not exceeding 20 ct. on the $100 on all property subject by law to local taxation, under Section 157a of the constitution, for the improvement or construction of the public roads and bridges of the county, either or both, as the fiscal court may direct. The order of the fiscal court calling the election shall specify the amount of the tax to be levied each year and the number of years for which the tax may be imposed, not exceeding 10 years, and shall also provide that no amount of money in excess of the amount that can be raised by the levy in any one year shall be expended in that year. It may also borrow money in any year, in advance of the collection of the tax for that year, not exceeding 80% of the estimated tax, and issue bonds therefor, the amount of the tax to be estimated, according to the assessment and collection of the preceding year, but any money so borrowed shall be paid out of the money raised from the tax in the year in which the money is borrowed. So that all indebtedness created in any one year shall be paid out of the fund raised in that year.
>
> Section 2. The fiscal court shall also in the order calling the election specify the amount of ad valorem tax to be levied each year, which shall be any sum not exceeding 20 ct. on the $100 of assessed property.

Section 3 indicates the form in which the question of taxation is to be submitted to the people, setting forth the proposed rate of taxation and the number of years for which the tax is to be levied, to be answered by the insertion of "Yes" or "No," and if a favorable vote is returned, the fiscal court is authorized to proceed to have the proposed improvement made.

The taxes are collected by the sheriff of the county after the manner followed in collecting other taxes, and he is allowed a commission of 1% of the total collections.

Section 5 of the law authorizes the sheriff to advertise the time and purpose of the election, and the amount of the annual levy for 30 days prior to it, in a county newspaper having the largest circulation.

Section 6 provides that the election be held by the regular election officers and the results handled in the same manner provided for regular elections.

The act is declared to be an emergency measure made necessary by the absence of an adequate system or law by which the counties could levy a tax for the purposes above referred to, and it became effective upon its approval, April 25, 1917.

Freeing Turnpikes in Pennsylvania

The final agreement for the purchase of the Lancaster Turnpike in Pennsylvania, by the state, which was noted in the issue of June 9, has been signed by State Highway Commissioner Black. The turnpike company valued the road and its franchise at $300,000, but concessions made reduced the price to the one finally agreed upon—$165,000.

The Philadelphia and Lancaster Turnpike Road Co. was chartered by a special act of the legislature April 9, 1792. Several sections of the road were made free from time to time by the counties through which they passed, and the remaining portion, now taken over by the State Highway Department, extends from the Philadelphia city line to Paoli, in Chester County. It is 14 mi. long, 4.49 mi. of which are in Montgomery County; 4.74 mi. in Delaware County, and 4.77 mi. in Chester County, all of the mileage being located on State Highway Route No. 142.

Commencing at Philadelphia, the pike extends through Wynnewood, Ardmore, Haverford, Bryn Mawr, Rosemont, Villa Nova, St. Davids, Wayne, Strafford, Devon and Berwyn to Paoli. The toll charges along this stretch of road are 70 ct., or about 5 ct. a mi., and are collected from nine toll houses along the highway.

The freeing of the Lancaster Pike leaves but 12 mi. of toll road between Harrisburg and Philadelphia. This section is located on State Highway Route 215, extending from Lancaster to Vintage over which a toll of 25 ct. is charged.

This is the second toll road taken over by the state this month. As noted in the issue of June 23, arrangements have been made by the State Highway Department for purchasing the turnpike which extends from Hummelstown, in Dauphin County, to Wernersville, in Berks County. The turnpike company is to be paid $70,000 for its property and franchise. One-half of this amount will be paid by the state; the other half will be paid by the three counties traversed by the highway—Dauphin, Lebanon and Berks—in proportion to the number of miles in each. The total mileage of the pike is 34.5, 4.99 mi. being in Dauphin County, 19.79 mi. in Lebanon County, and 9.72 mi. in Berks County. Fourteen toll houses are situated along this road: one each in Wernersville, Robesonia, Womelsdorf, Stouchburg, East Myerstown, West Myerstown, Half-Way, Narrows, Hebron, Sunnyside, Sporting Hill, Millard's Quarry, Palmyra and Junction. The toll exacted along the route amounted to $1.02, or about 3 ct. a mi.

The Hummelstown-Wernersville road was chartered by an act of assembly approved March 2, 1805, and incorporated in 1816. The original turnpike extended from the Schuylkill River to the Susquehanna River, but nine years ago the portion between Schuylkill and Wernersville was freed by Berks County. The section between Harrisburg and Hummelstown was freed by Dauphin County a few years ago.

The pike is on that portion of State Highway Route 139 extending from Harrisburg to Lebanon and also on that portion of Route 149 extending from Reading to Lebanon, and is 50 ft. wide. It was repaired recently by order of the Public Service Commission. While a number of details remain to be adjusted, it is stated by the department that the turnpike will be free to the traveling public by the middle of August. The work of freeing other toll roads will be carried on as rapidly as funds become available.

MEETINGS

Calendar of Coming Meetings

July 9-11.—North Carolina Good Roads Association.—Annual meeting, Asheville, N. C. Secretary, Dr. Joseph Hyde Pratt, Chapel Hill, N. C.

July 10-11.—Pikes Peak Ocean to Ocean Highway Association.—Midsummer meeting, Colorado Springs, Colo. Secretary, A. W. Henderson, Colorado Springs, Colo.

July 10-12.—Municipal League of Indiana.—Annual convention, Shelbyville, Ind. Secretary, W. S. Jones, Shelbyville, Ind.

July 26-27.—League of Michigan Municipalities.—Annual convention, Grand Rapids, Mich. Secretary, Charles A. Sink, Ann Arbor, Mich.

August 15-17.—League of Wisconsin Municipalities.—Annual convention, Racine, Wis. Secretary, Ford W. MacGregor, Madison, Wis.

August 22.—Union of New Brunswick Municipalities.—Annual convention, St. John, N. B. Secretary, James King Kelley, St. John, N. B.

August 27-29.—Union of Canadian Municipalities.—Annual convention, London, Ont. Secretary, W. D. Lighthall, K. C., Westmount, P. Q.

Resolutons Adopted at Meeting of Road Builders

At the meeting of representative men identified with highway improvement held at the Automobile Club of America, New York, N. Y., on the afternoon of Friday. June 8, and noted in "Good Roads" for June 16, tentative resolutions were adopted and referred to a committee to be revised and sent out to the various state highway departments and the governors of the several states. The resolutions, as finally adopted and transmitted, are as follows:

Whereas, the great increase in cost of building and maintaining roads and streets makes it necessary now to bring home to the public and to the representatives of the public, on whom devolves the road and street work of the country, the value of the country's highways both for commercial and for military purposes, therefore,

Be It Resolved: That it is the sense of this meeting that the highway departments of the several states should cooperate with the War Department of the United States in determining the highways of each state that are important from a military standpoint and also the requirements which such highways should meet, and

Be It Further Resolved: That it is the sense of this meeting that each state highway department should at once prepare a report on the highways in the state that are essential for the transportation of agricultural and industrial products, and

Be It Further Resolved: That it is the sense of this meeting that the governor of each state should file with the proper committee of the Advisory Council on National Defence, or with any body that may succeed to the powers and duties now vested in the said council, a memorial requesting that the railroads be not permitted to place an embargo upon the transportation of materials, machinery or equipment for use in the construction of roads of military value or required for the transportation of foodstuffs and other necessities, but that this class of freight be put on the preferred list.

As noted in "Good Roads," the committee consists of Robert A. Meeker, State Highway Engineer of New Jersey, Chairman; Carl Milliken, Governor of Maine; Col. William D. Sohier, Chairman of the Massachusetts Highway Commission; Charles W. Gates, ex-Governor of New Hampshire; James H. MacDonald, former State Highway Commissioner of Connecticut; John F. Richmond, Chairman of the Rhode Island State Board of Public Roads; George P. Coleman, State Highway Commissioner of Virginia; Arthur H. Blanchard, Professor of Highway Engineering, Columbia University; E. L. Powers, Editor "Good Roads."

American Society for Testing Materials

The twentieth annual meeting of the American Society for Testing Materials closed at Atlantic City, N. J., today. The program was announced in the issue of June 23.

Resolutions Passed by the Ohio Good Roads Federation.

At a recent meeting of the Ohio Good Roads Federation held in Columbus and attended by representatives of organizations interested in the furtherance of road building during the war, the following resolutions were adopted:

Resolved, first, that the efficiency of our industrial, commercial and agricultural activities should not be lessened or handicapped by war hysteria.

Second, that our financial resources are in healthy condition, no stringency in the money market exists; there is ample employment at good wages for all labor; that the agricultural districts promise an unusual acreage and harvest yield; that every pound of meat and bushel of grain the farm produces can be sold at profit prices; and that none of the factors that usually contribute to business depression now exist.

Third, that any policy of government that retards any useful activity will correspondingly harm other industries.

Fourth, that one great economic need of the farm and farmer is improved highways that will assist in transporting products of farm, field and garden to the market.

Fifth, that freight congestion in great centers of traffic creates imperative need for good highways to supplement railroads in transporting the product of the industrial and commercial world.

Sixth, that the war in Europe has already demonstrated that good roads are powerful adjuncts in national defense in the movement of armies, war munitions and all military supplies.

Seventh, that good roads are important factors in rural welfare, contentment and vitalizing of rural America; therefore be it

Resolved, that this conference urge the national and state administrations, state highway department, county commissioners, county surveyors, township trustees and municipal councils to adopt and go forward with a vigorous, progressive road building program. We commend all county commissioners and road builders who have gone forward in road building and are doing their utmost to place Ohio in the lead in the nation in the improvement of highways.

A committee was appointed to look after the road enterprises of the state. The committee consists of Royal Scott, of Toledo, Chairman; Clinton Cowen, State Highway Commissioner, Columbus; L. S. Bixler, Kenton; Charles J. Deckman, Cleveland; L. H. Hawblitz, Toledo; W. A. Alsdorf, Columbus; Ralph Cole, Columbus.

It has been decided to hold the annual convention of the League of Michigan Municipalities at Grand Rapids on July 26-27, instead of July 12-13, as previously announced.

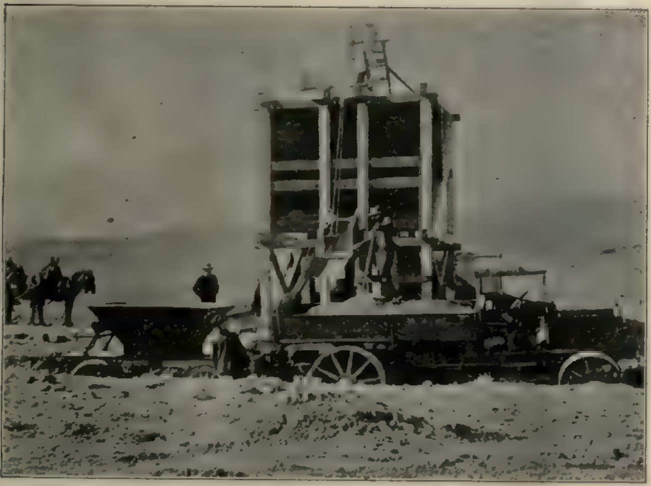
The Chicago Division of the Touring Club of America was formed recently in Chicago, Ill. The organization will promote road improvement and the enactment of just automobile laws. William G. Edens was chosen President; William F. Grower, First Vice President; Arnold Joerns, Second Vice President; Joseph E. Callender, Secretary, and Lucius Teter, Treasurer. The headquarters of the club will be in Chicago, the plan of the organizers being to have branch offices located in other cities in the United States.

EQUIPMENT — TRADE — MATERIALS

Mine Road Construction by Private Interests

Transportation is a most important factor in the profitable operation of mining properties, and it is often necessary to build a road from the mine to the most convenient point on a railroad. An instance of this is furnished by the Ladd mine, a manganese property in San Joaquin County, California, where a 3-mi. road has been improved by the use of the motor hauling equipment shown in the accompanying illustration.

The manganese ore was in such demand about 50 years ago that the owners of this property found it profitable to transport the ore by mules a distance of 32 mi. to Stockton, where it was loaded into boats and then carried 90 mi. to San Francisco to be again shipped by boat. Later when new mines were opened up in more accessible places it became impossible to meet the prices of competitors and operations were suspended. Shortly after the opening of the European War the price of manganese increased to such an extent that it again became possible to make the mine pay, and it was opened by M. C. Seagrave, a mining man of San Francisco.



LOADING TRUCK AND TRAILER OUTFIT WITH GRAVEL FOR IMPROVEMENT OF ROAD FROM THE LADD MINE TO CRUSHER—SAN JOAQUIN COUNTY, CALIFORNIA.

At first the ore was hauled from the mine to the crusher at Corral Hollow, 3 mi. away, by mule teams at a total cost of 95 ct. per ton of ore. The road over which the teams had to travel consisted of black adobe. From the upper ore chute of the mine there was a 20% grade down to the main road, and then a 10% grade down the mountains for a distance of 1½ mi. The balance of the road led over a wash where in summer the road was dusty and full of holes, and in winter was so muddy that the ore wagons would often sink to the axles. The latter condition usually made hauling impossible during wet weather. Because of the difficulties of hauling over the 3 mi. between the mine and the railroad, it was impossible to fulfill regular contracts, and it became necessary to take some steps to improve the transportation facilities. On the advice of a mining expert, to whom Mr. Seagrave had taken the problem, a white good roads truck and a 5-ton trailer were purchased to replace the mules and wagons. With this outfit it was possible to not only reduce the cost of hauling to 12.3 ct. per ton, but to materially improve the road.

The truck and trailer were delivered at the mine only 30 days before the commencement of the wet season, and it was necessary to rush the work of putting the road in condition before the rains. A gravel elevator was built in the creek bed near the ore crusher, and work was started on the graveling of the road. The truck and trailer were loaded at the ore chute at the mine, and the load taken to the crusher and dumped. The outfit was then driven to the gravel elevator, where it took on 10 ton of gravel, which was spread on the road on the return trip to the mine, the broad steel wheels of the truck rolling the surface hard and smooth. By the use of the truck and trailer the driver and one helper completed the road in 26 days, in the meantime carrying to the crusher all of the ore that was mined.

Large Order For Concrete Mixers.

The Ransome Concrete Machinery Co. of Dunellen, N. J., recently received what, according to the company, is probably the largest single order ever placed with a concrete mixer factory. The order was for 20 carloads of the machines known as the Ransome "Bantam."

S. W. Rebhann, the New York agent of the company, is a believer in the slogan "business better than usual" and is working with other agents of the Ransome Company to put that idea into effect. The factories at Reading and at Dunellen are working close to their capacities and it is reported that there is an increased export demand as well as great domestic activity.

"Protecting Concrete Work Done in Warm Weather"

A booklet bearing the above title has recently been prepared anl issued by the Portland Cement Association of Chicago, Ill. The booklet consists of 8 pages, and describes in some detail the necessity for preventing concrete from drying out, and the usual methods employed for protecting newly laid concrete, concrete materials and concrete products, with a few brief paragraphs relative to concreting in cold weather.

The booklet, which is attractively printed, is illustrated by half-tone reproductions of photographs showing concrete pavements protected by ponding, by canvas covers and by protective layers of earth. There are also two illustrations showing methods of protecting concrete pipe.

"Modern Methods in Concrete Construction"

An attractive booklet bearing the above title has been issued by the Hydrated Lime Bureau of the National Lime Manufacturers' Association of Pittsburgh, Pa., as Bulletin A-5.

The booklet contains data on the use of hydrated lime in concrete mixtures for bridges and other structures, with a partial list of important concrete structures in which the material has been used. Most of the information is contained in letters from engineers in charge of construction, and the text is enhanced by a number of illustrations of structures built of mixtures containing hydrated lime. A highway bridge at Miami, Fla., and the entrance to the Twin Peaks Tunnel at San Francisco, Cal., are among the structures illustrated.

The booklet is well printed on good paper, and the illustrations are excellent halftones. The booklet is 6x9 in. in size, and consist of 12 pages and covers.

National Tractor Demonstration

Announcement has been made of a national tractor demonstration to be held at Fremont. Neb., Aug. 6 to 10, inclusive, under the auspices of the Tractor Demonstration Committee, a body appointed by the National Tractor and Thresher Manufacturers' Auxiliary to the National Implement and Vehicle Association.

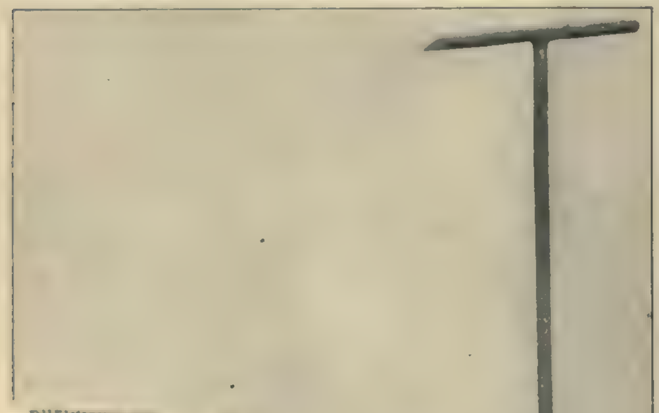
While the demonstration will consist principally of exhibitions of plowing, harrowing and other farm operations, the similarity of these operations to some of those incident to road building should make the tests of interest to contractors and others engaged in road work.

New Manhole Cover

A manhole cover that has recently been put on the market is shown in the accompanying illustration in which the cover is open and the key wrench is in position.

The cover is designed for use either in pavements or sidewalks in connection with any of the subsurface structures requiring manholes. It is especially recommended by the manufacturers for receptacles for cans used by street cleaners. The cover consists of a rim casting, the cover proper and the operating and locking mechanism. The latter is operated by means of a key about 3 ft. long with a "T" handle at the upper end. The working parts are simple and are packed in grease in a dirt and moisture proof housing.

To open the manhole the key is inserted in a slot near the edge of the cover and turned counter-clockwise. This unlocks the cover, raises it above the rim into the position in which it is shown in the illustration, and swings it back.



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The cover is known as the "pivot lock manhole cover," and is manufactured by the East Iron & Machine Co. of Lima, Ohio.

At the annual meeting of the Universal Portland Cement Company held at Gary, Ind., on June 13, B. F. Affleck was reelected President and T. J. Hyman, Secretary and Treasurer. The company is a subsidiary of the U. S. Steel Corporation and has offices in Chicago, Ill., Pittsburgh, Pa., and Minneapolis and Duluth, Minn. Its plants are situated at Buffington, Ind., Universal, Pa., and Steelton, Minn.

The contract for a narrow gauge railway for handling aggregate on a road job has been awarded to the Orenstein-Arthur Koppel Co. of Chicago by the Commonwealth Improvement Co. of that city. The outfit, consisting of 8½ mi. of Koppel portable track, Koppel dump cars and other equipment, is to be used in the construction of the Higgins Road, which is to be improved by the Commonwealth Improvement Co. under a contract recently awarded it. The road to be improved is about 18½ mi. long.

The second number of "Troy Factory and Field," a bulletin issued by the Troy Wagon Works Co. of Troy, Ohio, is entitled "Just a Word on the Characteristics of Materials" and is devoted to descriptions of wrought iron, malleable iron castings, cold drawn steel, spring steel, machine steel, cast steel, structural steel, seamless drawn steel tubing, brass and bronze and drop forged steel. The bulletin is in the form of a 4-page folder, 6½x8¼ in. in size, printed in red and black on buff paper.

PERSONAL NOTES

Robert T. Campbell has been made City Engineer of Brainerd, Minn.

Joseph G. Bulmer has been appointed County Engineer of Pike County, Ohio.

H. B. Cramer, Chief Accountant of the Bureau of Pubic Roads and Rural Engineering, died recently at his home in Washington, D. C.

C. S. Sincerbeaux, of Princeton, N. J., is conducting an examination of the bridges in Mercer County, for the County Board of Freeholders.

W. H. Breithaupt has been elected Chairman of the town planning commission of Kitchener, Ont. He is a member of the Canadian Society of Civil Engineers.

Charles Carroll Brown, formerly editor of "Municipal Engineering," Indianapolis, Ind., has disposed of his financial interest in that magazine and has retired from its organization.

W. A. Pollock, who has been connected with the Atlas Portland Cement Co. for more than twelve years, has been made General Superintendent of the Glens Falls Portland Cement Co., Glens Falls, N. Y.

Karl W. Bock has been appointed manager of the Walter A. Zelnicker Supply Company of St. Louis, Mo. For the st ten years Mr. Bock has been secretary of the Union cific Coal Company and subsidiary companies, and assist- to the vice president of the Union Pacific Company at oha, Neb.

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